

Department of Natural Resources' Investigative Review of Forest Practices Activities in the Vicinity of the SR 530 Landslide

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Executive Summary

Immediately after the March 22, 2014 SR 530, landslide, the Washington State Department of Natural Resources (DNR) initiated a review of forest practices activities in the vicinity.

Information provided in this report is based on approximately 10,000 pages of electronic and paper documents, and seventeen interviews conducted by DNR with current and former staff, and external individuals who participated in or had knowledge of the area's regulatory history.

The scope of the investigation includes:

- Describing the decision record of Forest Practices Applications (FPAs) adjacent to the SR 530 landslide; and, describe these FPAs' compliance status with respect to regulatory requirements in place at the time of approval.
- Describing the regulatory requirements in place at the time of FPA decisions and how those requirements were developed, including the Hazel Watershed Analysis (WSA).

Additional geologic study of the SR 530 landslide, its cause, and the cause of previous slope failures are outside the scope of this investigation.

FPA Decisions and Compliance

The record indicates the 2004 FPA (2807020) submitted by Grandy Lakes Forest Associates adjacent to the Hazel landslide groundwater recharge area, as approved by DNR, was in compliance with the rules. The FPA stipulated that harvest would not occur within the mapped Hazel landslide groundwater recharge area and therefore did not trigger a requirement for further study by the Hazel WSA. An earlier proposal to harvest within the recharge area was disapproved by DNR because it did not include the necessary study.

The primary factors determining the harvest's compliance with the rules are the location of the harvest boundary flag line in relation to the Hazel WSA mapped groundwater recharge area, and whether the harvest itself exceeded this flagged area or in some other way failed to comply with the FPA. Based on the information available, the compliance status of the harvest boundary flag line's location is inconclusive.

The Hazel WSA required that map unit boundaries were verified in the field by foresters or other resource managers, citing potential inaccuracies and limitations of the mapping. The applicant was responsible for locating the mapped groundwater recharge area boundary or the area topographically "directly upslope" that depicted the boundary, if there was in fact a difference between the two. It was known that three people knowledgeable about the WSA, including the author of a Hazel landslide study that was considered in the WSA (Miller), completed a site visit to review groundwater recharge area issues. However, the record is unclear about when, how, and by whom the line was installed.

Post-approval compliance visit documentation by DNR states the FPA was in compliance but does not further specify the extent of the site review. The FPA estimated 7.5 acres to be harvested whereas calculations based on aerial photography indicate approximately 8.5 acres

were harvested. The completed harvest was therefore not in compliance with the approved FPA's harvest acreage.

The compliance status was also reviewed for other FPAs within approximately one mile of the Hazel landslide on the north side of the North Fork Stillaguamish River that were received between 2004 and present. The record shows that at least one field review was conducted prior to approving each FPA, with one exception: a resubmittal of an earlier application that had already been field reviewed. Post-approval compliance checks were documented on three of the five approved FPAs during this time period.

The investigation found that several FPAs were disapproved by DNR or caused by DNR to be withdrawn by the applicant due to incomplete information. In other cases, extensive approval conditions were placed on FPAs which may have been designed to achieve the Hazel WSA and Forest Practice rules' protection requirements by correcting faults in incomplete applications. The practice is contrary to rule and program guidance because it results in some FPAs being approved without information that is required for a complete application.

Regulatory Requirements:

The final Hazel WSA reflected both the Benda (1988) and Miller and Sias (1997) studies. The Miller study was considered by DNR and the prescription team in the development of final maps and prescriptions for the Hazel landslide groundwater recharge area. The team did not recommend that DNR replace Benda's delineation of the potential Hazel landslide groundwater recharge area with the boundary that was generated by the Miller study's computer model outputs. The record lacks information about what factors may have been considered in this decision, and no further clarity was provided by interviews with the team participants. However, a science review was subsequently commissioned (2000) by the Cooperative Monitoring Evaluation and Research committee (CMER) to evaluate the use of the Miller study's method for delineating groundwater recharge areas statewide. The review cited areas of scientific uncertainty and recommended against the use of this method until uncertainties could be resolved.

The final prescription for the groundwater recharge area required that any forest practice activity proposed to take place within the map unit boundary should be analyzed using the Miller study's methods. FPAs that proposed harvest outside the boundary did not require this additional study.

Part 1 Introduction

Background

The SR 530 landslide occurred on March 22, 2014, on the north side of the North Fork Stillaguamish River in Snohomish County, Washington, approximately 15 miles northeast of the town of Arlington and 10 miles west of the town of Darrington. The event became the deadliest landslide in United States history, tragically claiming the lives of 43 people.

Immediately after the SR 530 landslide, the Washington State Department of Natural Resources (DNR) initiated a review of forest practices activities in the vicinity. Questions were raised about the role that past timber harvests may have played in contributing to the landslide and about decisions made by DNR in implementing regulatory protections, with particular focus on a triangle-shaped harvest in 2004 that was visible at the landslide's headscarp.



Under Washington state law, forest practices are activities “conducted on or directly pertaining to forestland and relating to growing, harvesting, or processing timber” (RCW 76.09.020(17)). Washington state’s forest practices regulatory program prescribes minimum standards and procedures to achieve protection of public resources such as water, fish and wildlife on more than 12 million acres of private and state-owned forestlands. Forest practices are regulated through rules (Title 222 WAC) established by the Forest Practices Board (Board) and administered by the DNR Forest Practices program under authority of the Forest Practices Act (Chapter 76.09 RCW) and the Salmon Recovery Act (Chapter 77.85 RCW). The Board is charged with creating rules to protect the state’s public resources while maintaining a viable timber industry. Forest Practices rules address many types of protections, among them protections related to potentially unstable slopes.

Prior to 2014 the site of the SR530 landslide was commonly referred to as the “Hazel landslide.” This name is used to refer to the site of a series of slope failures that have occurred over time, not any single event. Documents and information used throughout this investigation that originated prior to March 22, 2014, therefore, refer to the Hazel landslide. Slope failures at the Hazel landslide site were well documented by DNR. The site is considered an active deep-seated landslide that has made an impact on the channel and fisheries resources of the North Fork Stillaguamish River for more than 60 years.

Report Objectives:

- Describe the regulatory requirements in place at the time of FPA decisions and how those requirements were developed, including the Hazel Watershed Analysis (WSA).
- Describe the decision record of Forest Practices Applications (FPAs) adjacent to the SR 530 landslide, including the 2004 FPA.
- Describe these FPAs’ compliance status with respect to regulatory requirements in place at the time of approval.

Additional geologic study of the 2014 SR 530 landslide, its cause, and the cause of previous slope failures are outside the scope of this investigation.

The primary geographic scope of this report is the area upslope of the landslide and west of Rollins Creek. FPA information was also reviewed within an approximately one mile radius of the landslide on the north side of the North Fork Stillaguamish River.

Documents and Information Sources:

Information provided in this report is based on approximately 10,000 pages of electronic and paper documents, including:

- Available DNR records on FPAs issued near the landslide area.

- Available DNR records describing the regulatory requirements, policies, and procedures in place at the time each FPA decision was made.

- Seventeen interviews conducted by DNR with current and former staff, and external individuals who participated in or had knowledge of the area's regulatory history. Additionally, ten individuals provided general information. (Appendix E)

Electronic and paper records were identified from the DNR Northwest Region office in Sedro Woolley and the Forest Practices Division in Olympia. Some records are limited due to the period of time that has elapsed since prior decisions were made, and the record retention guidelines described below. Numerous knowledgeable staff that worked in the area either no longer work for DNR or are deceased. Specific documents are referenced throughout the report, identified in a reference list, and included in Appendix C. The referenced documents are available to the public from DNR's Public Disclosure section.

Public Record Retention

FPA processing before November 1996 was conducted using paper means. Beginning in approximately November 1996, electronic processing resulted in some files being available after the paper documents were destroyed per record retention requirements.

The current public record retention schedule for FPA documents is for a period of ten years. Prior to 2009, the retention period began when the FPA expired. Beginning in 2009, the retention period began on the last action taken by DNR.

While the retention schedule identifies when agency files may be destroyed, in some cases records remain active for longer periods of time, are kept for other reasons or are simply not destroyed when the schedule allows.

DNR record retention schedule for FPA documents

2000-2008: Reduced time period to retain FPAs from 50 years to 10 years starting when the FPA expires.

2009 to present: Several individual retention schedules were combined and the starting point for retention was the expiration or date of last department action.

Land Ownership

Property surrounding the Hazel landslide on the north side of the North Fork Stillaguamish River is primarily forestland managed for commercial timber production. A mix of forest management, agriculture, and rural dwellings are the primary land uses on the south side of the North Fork Stillaguamish River.

Forestland on the north side of the river is primarily owned by Grandy Lake Forest Associates, LP (Grandy Lake) and the State of Washington. The state owned land is managed by DNR for its trust beneficiaries.

The state land is managed by the DNR Northwest Region Office in Sedro Woolley. Grandy Lake's property is managed by Arbor Pacific Forestry Services (Arbor Pacific), a consulting business in Mount Vernon. DNR records indicate that Summit Timber managed the property until January 11, 1989, when DNR received notification that Grandy Lake assumed ownership.

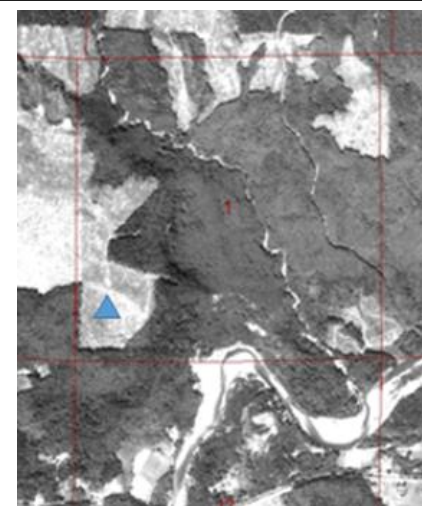
Part 2 History of Regulatory Requirements

The Forest Practices regulatory requirements applicable to forestland in the vicinity of the SR 530 landslide—and statewide—have changed significantly over time. This section of the report includes requirements and analyses that resulted from a 1988 harvest proposal by Summit Timber adjacent to the landslide, an overview of the watershed analysis process, and the development of the Hazel WSA beginning in 1994 and concluding in 1998. Together, these form the basis of the regulatory requirements applicable to all FPAs approved by DNR from 1998 to 2013.

2.1 1988 Summit Timber FPA 1909420

FPA 1909420 was submitted by Summit Timber on April 8, 1988, and resulted in a lengthy review process that did not conclude for more than two years. Several documents were produced over the course of this FPA that are widely referenced in later documents and decisions regarding groundwater recharge areas above glacial deep seated landslides.

The FPA proposed a clear-cut harvest of 440 acres in Sections 1 and 12, Township 32 North, Range 7 East. A portion of the proposed harvest area was located in the southwest quarter of Section 1 Township 32 North Range 7 East, northwest of the Hazel landslide, which had also been referred to as “clay slide” or “slide hill” in the past. The FPA was approved on May 5, 1988, following the first of what would eventually be four Interdisciplinary (ID) Team meetings. **ID Teams are discussed, along with other basic Forest Practices program requirements and application processing steps, in Appendix A.**



A 1991 aerial photo indicating the area harvested within Section 1 Township 32 Range 7 East under FPA 1909420. This section of the report focuses on the area in the vicinity of the blue triangle.

ID Team Number 1:

This ID Team was led by Andy Anderson, DNR Forest Practices forester in Northwest Region, and took place at 9 a.m., May 5, 1988, prior to the FPA’s approval.¹ Participants, in addition to Anderson, included:

- Walt Robinson and Bob Boyd – Summit Timber landowner and timber owner/operator
- Mike Chamblin – Washington State Department of Fisheries
- Noel Wolff – DNR soil scientist
- Kurt Nelson – Tulalip Tribes

The meeting resulted in several clarifications to the harvest area near “clay slide” in Section 12. Documents from the ID Team meeting indicate that: “The cutting boundary along the scarf (sic) area and clay slide area on the west side of Rawlins (sic) Creek was reviewed (walked). The

boundary was good except for the portion adjacent to the clay slide. An existing geological report was needed for review prior to completing recommendations for this portion of the boundary.”

Noel Wolff, DNR soil scientist, completed a geologic evaluation memo of FPA 1909420 dated June 7, 1988.² Wolff’s memo states, in part:

- “I think it is safe to assume that with or without the proposed harvest it is only a matter of time until another significant failure occurs at Hazel...”
- “Past slope instability was ground water perched on glacial lake sediments deep within the terrace. The proposed timber harvest will directly affect the terrace and I do not anticipate that surface erosion or shallow slope failures will result from harvesting.”

Wolff concluded that removal of existing vegetation would probably temporarily result in additional water available for percolation into the terrace. The amount of water would decrease as vegetation was reestablished.

Wolff summarizes his opinion as: “...timber harvesting could possibly cause what is likely an inevitable event to occur sooner. However, available and reasonably attainable facts do not provide definitive answers regarding the effect of harvesting on stability of the terrace escarpment. It then becomes a question of the degree of risk (comfort level) the landowner chooses to accept in harvesting timber on the terrace.” Wolff referenced:

“Geologic Report on the Slide Area Near Hazel, North Fork of the Stillaguamish River, Wash.” By Howard A. Combs, Professor of Geology, University of Wash. Appendix A of the report by W.D. Shannon, dated February, 20, 1952.³

“Condition Report: Halterman Slide on the North Fork of the Stillaguamish River” by R.D. Webb and W. H. Rees, Wash. Dept. of Fisheries.⁴ .

“Landslide of January 1967 Which Diverted the North Fork of the Stillaguamish River near Hazel” memo by Gerald W. Thorsen, Wash. Division of Mines and Geology. November 28, 1969.⁵

ID Team Number 2

This ID Team meeting appears to have taken place on June 13, 1988, to review the Hazel landslide report by Noel Wolff dated June 7, 1988. The report was in the form of a memorandum to the file of FPA 1909420. The ID Team meeting was attended by the same people as ID Team No. 1 except Walt Robinson did not attend.⁶ The meeting was documented in an Informal Conference Note (ICN; an ICN is one of several forms of enforcement documentation, see Appendix A), which states that:

“The proposed boundary is accepted. The boundary must be maintained in a minimum 50 foot from the slide edge. No equipment will be used within this zone. Any trees to be cut within this zone will be marked. Use care to avoid damaging residual vegetation within the zone.”

The ICN did not include a map or other description of the exact location of the 50-foot zone.

A memo was sent on June 30, 1988, to participants of ID Team No. 1 and No. 2 by the DNR Northwest Region Timber/Fish/Wildlife (TFW) Coordinator.⁷ The memo references concerns that were shared following the June 13 meeting and that another ID Team will be held. The specific concerns raised are unclear in the memo. The memo states the team will include individuals with earth science expertise and the Washington Environmental Council (WEC) will attend as an observer.

ID Team Number 3

This ID Team meeting was held on July 21, 1988.⁸ The team included:

Lee Benda – University of Washington hydrologist, geologist
Jerry Thorsen – DNR contractor, geologist
Sally Safioles – Washington State Department of Ecology (ECY)
Greg Ariss – DNR Forest Practices District Manager, Northwest Region
Walt Robinson – Summit Timber

The following observers attended:

Shelly Weisberg, Lisa Lombardi – WEC
Jeannie Summer – ECY
Noel Wolff, Dick Skvorak (Forest Practices Coordinator, Northwest Region), and Ken Hires – DNR

ICN documents indicate Lee Benda would provide a report from the team members by August 15, 1988, addressing timber harvest above the slide on the slide stability, mitigation and recommendations.

Prior to Benda's report submittal; Sally Safioles, ECY hydrogeologist, submitted a letter to Lee Benda dated August 10, 1988.⁹ She states that:

“...soils which underlie the proposed timber harvest are permeable sands (approximately 400 feet) over relatively impermeable silt. The mechanism for the sliding is water saturating the permeable material (sand) which is then impeded by the impermeable layer (silt) which becomes the slip plane. Evidence for this is the presence of springs in the contact area between the sand and silt. The saturation, or damming (sic), of water in the sand layer causes the material to lose cohesion as the pore-water pressure is increased therefore making the material unstable.”

“...landsliding (sic) will probably happen again. It would seem reasonable to assume that deforestation will increase the ground water supply through the permeable sands and therefore accelerate process. But, I have no idea of how to put a time frame on the landsliding (sic) potential whether there is logging or not. Or of what magnitude to expect and therefore the environmental impact.”

The record includes a letter from Lee Benda to Dick Skvorak dated August 12, 1988, which presumably is the report requested at ID Team No. 3 and documented in the ICN. Excerpts of Benda’s letter¹⁰ indicate two possible locations of instability:

1. “...failure plane is located at the contact between the outwash sand deposit and the clay and thus slope stability would be strongly controlled by ground-water conditions. Since the North Fork Stillaguamish River would be located below the failure plane, it is probably not directly involved with continued landslide activity. Timber harvest activity above and within the drainage which supplies ground water to the slide, such as the proposed Summit Timber Sale, would increase ground-water flow by reducing evapotranspiration which would reduce the stability of the slide area.”
2. “...failure plane is located within the lacustrine deposit; this plane could be located below the surface of the river, and hence continued erosion of the clay deposit by the river would reduce the stability of the slide. Therefore, even though timber harvest would decrease the stability of the slide by increasing ground-water conditions, the stability of the slide would also be a function of the rate of river erosion.

Excerpts of Benda’s recommendations include:

Timber harvest within the drainage of the slide would increase instability to the extent that additional landslide activity is likely;

- that portion of the sale area within the topographic watershed boundary of the slide area should be deleted from the timber sale; and
- a more comprehensive field study to accurately determine the conditions influencing instability of the area should be conducted prior to timber harvest because of the important fishery resources of the Stillaguamish River.

Forest Practices forester Andy Anderson issued a Forest Practices Stop Work Order (SWO)¹¹ ; a SWO is one of several forms of enforcement document, see Appendix A) on August 18, 1988, which states: “No work may be done on the slopes above the area known as the “Hazel Slide” until September 15, 1988”. The order was based upon potential damage to the river.

ID Team Number 4

A second SWO was issued on Sept 16, 1988,¹² requiring ID Team No. 4 and a report by October 15, 1988, before work on the slopes adjacent to the Hazel slide could resume. This ID Team was scheduled for September 30, 1988. “No decisions were made. A report will be made by the ID Team to outline the hydrology of the cutting unit and possible effects of harvest.”¹³

Members included:

Lee Benda –University of Washington hydrologist / geologist
Jerry Thorsen – DNR contractor, geologist
Stephen Bernath – DNR hydrologist
Walt Robinson – Summit Timber
Andy Anderson -- DNR Forest Practices forester

The following observer attended:

Paul Kennard –Tulalip Tribes

A third SWO issued on Nov 2, 1988, indicates that the ID Team report, report review, and FPA will be finalized by Nov 30, 1988.¹⁴

An ICN dated Nov. 23, 1988,¹⁵ by Andy Anderson summarized the information reviewed and identifies the following conditions for proceeding with harvest activities (DNR has the authority to further condition the approval of FPAs, see Appendix A):

- 1) About 48 acres as shown on attached report and map are not approved for harvest at this time.
- 2) The boundary of the area to be harvested must be marked on the ground prior to cutting.
- 3) Notify the Stillaguamish Forester prior to starting any additional timber harvest on this area.
- 4) All previous stop work orders are rescinded.

Dick Skvorak wrote a memo to the FPA 1919420 file on December 2, 1988,¹⁶ documenting the following:

ID Team briefed NW Region Forest practices staff on November 23, 1988 on their findings and we went over the Draft ID Team (Oct 30, 1988) Report. As a result of questions asked at the briefing portions of the report were clarified and we received the report by fax on 11/28/88.

On 11/29/88 I was informed of the slide that occurred on 11/24/88. I called Steve Bernath and found out he was enroute to view the slide. I talked to Steve that morning when he called from Arlington to see if we had any more information. I told him that Noel Wolff, Garth Anderson and Andy Anderson were flying the slide and that was the extent of further knowledge. I talked to Noel and Garth and they had no information to change the conclusions of the clarified report.

On 11/30/88 AM I talked to Steve and he said the conclusions of the report were still valid. I pointed out to Steve factual inconsistencies as the slide of 11/24/88 was not mentioned in the report. Steve said he would contact the other team members and get back to me if any recommendation made by the team needed to change. By 3pm I hadn't heard from Steve. I then talked to Andy Anderson to see if he felt the need to change any of our conditions. Andy said no, and I filled out the notice to comply and had Diane

process the paper work at 1630 hours a received ID Team report was received by fax that included an evaluation of the 11/24/88 event.

In early am of 12/01/88 I reviewed the revised report line by line with the report in the file. All changes were marked and the conditions on the Notice to Comply were evaluated against the reports and with my telephone conversations with Steve Bernath and Andy Anderson. I also had a talk with Jerry Thorsen.

... I made the decision the conditions were still valid and no changes were made.

1988 "Benda report"

The widely cited document entitled *Report of the I.D. Team Investigation of the Hazel Landslide on the North Fork of the Stillaguamish River* (1988), authored by Lee Benda, Gerald Thorsen and Stephen Bernath was the result of the series of events around FPA #190420. The report provides a map delineating the groundwater-source areas of the Hazel landslide. The file contains three versions of the Benda report; October 30, November 23, and November 30, 1988. The final November 30, 1988, version recognizes the slide activity that occurred on November 24.

The Benda report (page 9)¹⁷ identified the following conclusions and recommendations:

- The primary triggering mechanism of the Hazel landslide is groundwater. The erosive action of the river contribute to the instability by removing old landslide debris thereby preventing the slope from attaining a lower-gradient profile. Groundwater in the slide mass has two main sources: i) the hillside and terrace immediately west-northwest of the slide; and ii) the basin of Headache Creek.
- Timber harvest in either of the two groundwater recharge areas would increase groundwater flow from 20 percent to 35 percent, due to the loss of evapotranspiration, for approximately 16- 27 years. Increased groundwater flow to the Hazel landslide would reduce the stability of the slide. The exact amount of destabilization is not known nor is it possible to predict the monthly or seasonal precipitation necessary to result in failure with or without timber harvest. However with increased groundwater due to timber harvesting, the likelihood for failure increases because the magnitude and hence the recurrence interval of the storms which contribute to failure would be decreased.
- The greatest activity and growth of the slide occurred on the order of 10 to 15 years following harvest in first groundwater source area (harvesting in 1940) and then the other (harvesting in 1960). This is within the period of time (approximately 20 years) that increases of groundwater would occur due to loss of vegetative cover. This observation is further substantiated by the absence of slide activity during the 1980's, a period of time when the vegetation within the recharge areas had attained hydrologic maturity, despite very large storms which also occurred during this same time period..
- Any assessment of the future activity of the Hazel landslide, including the effects of timber harvest, must take into account the possible capture of Headache Creek by the slide. If Headache Creek was captured and rerouted south into the interior of the slide, the size (are and depth) and activity of the slide would be greatly increased. The slide may

then quickly erode headward following the drainage course of Headache Creek. We feel that this possible scenario warrants an extremely conservative approach when considering the possibility that timber harvesting would reactivate the slide.

Recommendations:

Given the objective to not increase the likelihood (or probability) of sliding over that of natural conditions then we recommend that no timber harvest take place in the areas responsible for supplying groundwater to the Hazel Slide. The areas include those shown in figure 1 and marked Groundwater Source Areas 1 and 2. Therefore, we recommend the deletion of that part of the timber harvest that is with the Groundwater Source areas 1 and that portion of 2 which is part of the basin of Headache Creek shown in figure 1.

Application of the Benda report

The Benda report recommendations were formalized in a Notice to Comply (NTC; an NTC is one of several forms of Forest Practices enforcement document, see Appendix A) on November 30, 1988.¹⁸ The NTC amends the approved FPA and rescinds all previous SWOs. Conditions include:

- 1) About 48 acres as shown on the attached report and map are not approved for harvest at this time.ⁱ]
- 2) The boundary of the area to be harvested must be marked on the ground prior to cutting
- 3) Notify the Stillaguamish Forest Practices Forester 48 hours prior to starting any additional operations.

Notes from Andy Anderson dated January 11, 1989, say:

“12/6 Walt and I marked boundary to delete 48 acres from being harvested
12/13 Cutting started.”

On December 7, 1988, Summit Timber requested a DNR administrative review of the NTC based on WAC 222-46-030(3). A hearing was conducted on January 11, 1989, by Harold Villager, Northwest Region Manager. The hearing proceedings were tape recorded and documented in a Final Order on February 28, 1989.¹⁹ Hearing highlights include:

- November 30, 1988, Benda version was an attachment to the final order. The Benda report addressed clear-cutting.ⁱⁱ
- At the hearing, Summit proposed an alternate harvest plan to replace the clearcut plan on the 48 acre parcel. The alternate plan consisted of 50 percent stem removal on the terrace above the slide and 30 percent stem removal on the slopes above the slide.ⁱⁱⁱ []
- The hearings officer suggested a site visit to review alternate harvest plan locations.
- A site visit occurred January 13, 1989.

ⁱ In the Benda Report (Endnote #17), Figure 2 area is indicated as “Deleted portion of FP19-09420”

ⁱⁱ Final Order, Background item 3 on page 1 and Attachment A of Endnote #19

ⁱⁱⁱ Final Order Part I Background item 6 and 7, page 2; area that was removed from the FPA under the NTC issued 11/30/1988 by Skvorak Reference 18

- The hearings officer asked an additional question on February 15, 1989: What percent of forest canopy can be removed without measurably increasing water availability for groundwater recharge?^{iv}

A technical team of two DNR hydrologists (Noel Wolff and Stephen Bernath) and a silviculturist (Mike Nystrom) completed a literature review and response for the hearings officer. The document entitled *The Effects of Partial Forest-Stand Removal on the Availability of Water for Groundwater Recharge* was completed on February 27, 1989.^v

Wolff's report concludes: "Studies cited in the literature indicate that up to 20 percent of the forest cover can be removed without creating a detectable increase in water yield. The water yield increases cited in those studies are probably not directly applicable to Hazel due to differences such as geology, soils, precipitation, harvest patterns and methods, and post-harvest site treatment. These conditions, coupled with the proposed operational restrictions ... suggest that the magnitude of water yield increases at Hazel would be somewhat less than generally quoted in the literature."¹⁹

The Final Order dated February 28, 1989, modified the NTC that was issued on November 30, 1988,¹⁹ as follows:

- No clear-cut harvesting may take place on the 48-acre unit.
- Partial cut harvesting on 48-acre unit may take place provided that all of the following operational conditions are satisfied:
 - a) 75 percent or more of the existing tree canopy must remain after harvest.
 - b) The remaining canopy shall be representative of the pre-harvest stand and shall contain evenly distributed vigorous crowns of conifer trees.
 - c) No additional roads may be constructed in the 48-acre unit.
 - d) Yarding will be accomplished using cable skyline or other aerial harvest systems.
 - e) Prior to harvest, the landowner/timber owner must submit to the Department (DNR) for approval a detailed plan addressing items a through d above. The plan must describe how the operation will be constantly monitored to ensure the objectives are met.
 - f) After the plan is approved, the DNR will require two full working days notice prior to any harvest activities taking place.^{vi}

At the time, FPAs were required to be completed within one year of approval, or landowners could request that they be renewed by DNR. FPA #1909420 was renewed on March 7, 1989. Grandy Lake was identified as the landowner at the time of renewal, indicating a change of ownership from Summit Timber. The file includes an undated map indicating the area harvested and areas remaining. The new FPA expiration date was March 7, 1990.²⁰

^{iv} Endnote 19: Final Order, Attachment D

^v Endnote 1, Villager, Attachment G

^{vi} Final Order (Endnote 19), Part III, Courses of Action, page 6

WEC (represented by Perkins Coie) filed an appeal of the NTC and Final Order on March 29, 1989, with the Forest Practices Appeals Board (FPAB), case number FPAB 89-5. The record indicates that the Tulalip Tribes of Washington was an intervener in the case.²¹ A settlement was reached with the parties and the FPAB case was dismissed. Kathryn Gerla of the Office of the Attorney General wrote a memo to DNR dated August 17, 1990, describing the settlement terms, which states:

Summit Timber agreed not to harvest the area subject to the notice to comply for a period of 10 years, until May 3, 2000. This restriction runs with the land. In return, WEC and the Tribes agreed to release the landowner from any claims or causes of action due to landslides alleged to have been caused by road construction or other activity under taken by Summit in the area prior to settlement of this case.

DNR is not a party to this agreement, has incurred no obligation under the agreement, and is not responsible to enforce it. Therefore, if an application is submitted to harvest in that area within the next 10 years, DNR must approve, condition or disapprove the application based on existing forest practices laws, and cannot disapprove it because of the private settlement agreement. It is up to WEC and the Tulalip Tribes to enforce that agreement.

However, pursuant to my March 20 letter to WEC's attorney, DNR has agreed to note on TRAXS (*Author's note: "TRAXS" is an acronym for Total Resource Access Cross-reference System, an early method of screening FPAs for resource concerns by location*) the existence of a landowner agreement not to harvest for 10 years, and to send WEC and the tribes a copy of any forest practices application received for that area and the associated TRAXS printout. I believe the appropriate notation has already been put on TRAXS. If not, that should be done in the near future.

2.2 Watershed Analysis Overview

Background

The Board adopted rules effective on August 1, 1992, to address concerns regarding cumulative effects, "defined as changes to the environment caused by the interaction of natural ecosystem process with the effects of two or more forest practices." (Chapter 222-22 WAC) These changes arose from provisions of the 1987 TFW Agreement.

Watershed Analysis (WSA) was the approach adopted by the TFW Agreement and the Board to provide a biological and physical assessment of the condition of fish, water, and capital improvements of the state or its political subdivisions, and design forest practices requirements—called prescriptions—that would promote recovery of these resources. The long-term objective of WSA was to protect and restore public resources and the productive capacity of fish habitat adversely affected by forest practices. The role of WSAs has changed through time and these changes are discussed later in this section.

WSAs were conducted at the scale of a Watershed Administrative Unit (WAU), which were generally ten thousand to fifty thousand acres in size. A WSA included three distinct parts: assessment, synthesis, and prescriptions. Collectively, the three parts are termed watershed analysis. Analysis steps included an assessment completed by a group of watershed resource analysts, specialists, field managers, and experts whose qualifications were prescribed by DNR.

Any landowner, and any cooperating group of landowners, of 10 percent or more of the nonfederal forest land acreage in the WAU and any affected Indian Tribe were entitled to include one qualified individual to participate on the team at their own expense. Prescriptions were written for each Area of Resource Sensitivity (ARS) identified in the assessment. These prescriptions were to be designed to prevent or avoid the likelihood of adverse change that has the potential to cause a material, adverse impact to resource characteristics.

Watershed Analysis Board Manual

In addition to the WSA rule requirements found in Chapter 222-22 WAC, the Board approved Forest Practices Board Manual (Manual) Section 11, *Standard Methodology for Conducting Watershed Analysis* on August 12, 1992. Manual Section 11 has been updated five times; the most recent update was in May 2011. Section 11 provided detailed information on the procedural and analytical expectations of WSAs. The analysis included distinct initiation, assessment, synthesis, prescription writing and monitoring phases. The assessment phase consists of numerous watershed process assessments and public resource analysis modules, the required methods for which are detailed in the Section 11 Appendices.

Watershed Analysis Process

The WSA process could be initiated and led by a landowner or group of landowners that owns more than 10 percent of the nonfederal forest land within the WAU, or by the DNR Forest Practices Division (WAC 222-22-070). A team of individuals with required expertise in forestry, forest hydrology, forest soils or geology, fisheries science, or geomorphology were identified to complete the assessment portion of the WSA. The analysis team included the lead analyst for each assessment module and members of the prescription team. Some assessment modules used more than one individual to complete the work.

The process provided two potential levels of assessment detail. The first was a Level 1 watershed resource assessment (WAC 222-22-050(1)). A more complex Level 2 assessment was required when the Level 1 “contains any areas in which the likelihood of adverse change and deliverability or resource vulnerability are identified as indeterminate...,” or when the Level 1 assessment team recommended a Level 2 watershed resource assessment (WAC 222-22-050(4)). In conducting a Level 2 assessment, the analysis team could review all portions of the Level 1 assessment or only those areas that received an indeterminate rating (WAC 222-22-060(2)(b)). An analysis team also had the option to skip Level 1 and proceed directly to Level 2. Assessment module reports and prescriptions were reviewed according to the DNR Administrative Guidelines for the Technical (Peer) Review Process,²² dated August 7, 1997.

Required qualifications for a watershed analyst were described in WAC 222-22-030. Typically, a graduate degree was required. In addition, DNR provided training for qualified analysts, specialists, and field managers. DNR was required to maintain a list of qualified individuals and to disqualify those who did not meet the requirements.

Determinations of Adverse Change

A Level 1 assessment determined the current condition of all public resources within the WAU, and assessed the likelihood of adverse change to those resources and amounts of material (water, sediment, wood, etc.) delivered to public resources as a result of forest practices activities. The analysis team further rated the likelihood of adverse change as high, medium, low, or indeterminate for each ARS (WAC 222-22-050(2)). Specific decision criteria for these ratings were described in the Manual Section 11 Appendices pertaining to each assessment module.

“Indeterminate” ratings resulted in the progression to a Level 2 assessment. The Level 1 team made a recommendation regarding the need for a Level 2. Manual Section 11 described the process that the Level 2 specialist (analyst) and team members could use to identify the scope of the analysis. An “indeterminate” rating for landslide hazard (referred to at the time as “mass wasting”) was used when: landslide density was unknown; future slope behavior was unpredictable; sensitivity to forest practices was unknown or unpredictable; or the likelihood of sediment delivery was unknown (see Appendix A, Board Manual Sec. 11). Level 2 assessments were common for mass wasting (unstable slopes) prescription development.

Review and Decision Processes

DNR policy was that draft WSA assessment module documents and prescriptions underwent peer review by a qualified individual.²² By rule (WAC 222-10-035) the State Environmental Policy Act (SEPA) process was used by DNR to review and approve or disapprove the final analysis and the prescriptions. The SEPA documentation was circulated to ECY, Washington State Department of Fish and Wildlife (WDFW), affected Indian Tribes, local governments, forest landowners within the watershed and the public.

Upon receipt of a completed draft WSA from an analysis team, DNR was required to review comments, make revisions, and approve or disapprove the recommended prescriptions within 30 days. The recommendations developed by the analysis team were required to “be given substantial weight” (WAC 222-22-080(1)). The basis for disapproving a draft analysis could only include: that the analysis team failed in a material respect to apply the required methodologies or the team could not reasonably have come to the conclusions identified in the assessments; and the protections resulting from the analysis will not accomplish the purposes and policies of rule and statute (WAC 222-22-080(3)).

Following approval of the WSA, prescriptions became requirements for FPAs located in a specific ARS if the applicant did not wish to undergo SEPA review of the FPA as a Class IV-special application (see Appendix A). FPAs that were in adherence with the prescriptions did not require SEPA and were processed as Class III applications; if an applicant wished to submit an FPA that did not follow the prescriptions, SEPA would be required. DNR was not authorized to

apply further conditions on the approval of FPAs in an ARS in a WAU where the applicant used a prescription contained in the WSA, nor to further condition FPA approvals outside an ARS in a WAU (WAC 222-22-090(1)). Where a Level 1 assessment was approved pending the completion of a Level 2, DNR selected and implemented interim prescriptions (WAC 222-22-050(5)).

Watershed Analysis and Unstable Slopes through Time

Prior to 2011, once approved, no provision of rule existed to modify a properly completed WSA or its prescriptions without initiating a reanalysis process and conducting a SEPA analysis (WAC 222-22-090). WSAs were required to be reevaluated every 5 years or when a significant change in conditions occurred (WAC 222-22-090(4)). If a reanalysis was determined to be necessary, either the participating landowners or DNR, or both, would bear the cost of conducting the process (WAC 222-22-090(5), (7)).

In 1999, the State legislature passed the Salmon Recovery Act (commonly referred to as “Forests & Fish”), which instituted the modern-day framework of FP rules. In promulgating emergency rules to put Forests & Fish requirements in place, the Board superseded riparian buffer prescriptions of approved WSAs (WAC 222-22-070(3)), but left unstable slopes and all other prescriptions in place (see Appendix A for additional information).

DNR and landowner work on WSA development largely ceased in the period of negotiations that preceded the Forests & Fish Report (the policy report upon which the Forests & Fish law is based) and the subsequent implementation of the Forests & Fish emergency rulemaking. Following the emergency rules’ adoption, the funding and initiative for WSA was largely eliminated. The Board’s continued work on unstable slopes and watershed processes was assigned to the Board’s Adaptive Management Program (AMP) (WAC 222-08-160(2)).

The purpose of AMP is to determine the effectiveness of forest practices rules in aiding the state’s salmon recovery effort and provide recommendations to the Board on proposed changes to Forest Practices rules. The specific components of the AMP are set forth in WAC 222-12-045. AMP operates at the direction of the Board, independently of DNR. It is comprised of a policy arm and a science development arm, which is called the Cooperative Monitoring, Evaluation and Research Committee (CMER).

A significant focus of AMP was to develop science-based methodologies that a field practitioner could use to implement the new Forests & Fish rules (called “rule tools”). On unstable slopes, “rule tool” development was assigned to CMER, specifically its Upland Processes Science Advisory Group (UPSAG).

For example, the methods for modeling the delineation of groundwater recharge areas developed by Miller and Sias (1997) as part of the Level 2 Hazel WSA were evaluated by CMER as a potential “rule tool.” Initiated in 2000 and completed in 2003, the publication “Estimation of multi-season evapotranspiration in relation to vegetation cover for regions in rainy-winter/dry-summer climate”²³ was undertaken to address challenges in implementing the groundwater

recharge area protections of the Forests & Fish rules. The CMER report was authored by Sias and describes its purpose as:

This rule has two problems. First, it is based on an unproven hypothesis that forest management can initiate deep-seated landslides. Second, no accepted methods exist for evaluating the physical effects of timber harvest on deep-seated landslides.

The publication was a peer-reviewed product of UPSAG and, in summary, made the following recommendations regarding the use of the Millar and Sias model as a standard methodology:

Near-term research efforts should focus on making *empirical* determinations of the degree to which 1) cumulative winter evapotranspiration over forest (sic) is non-negligible, 2) vegetation conversion results in a significant decrease in cumulative winter evapotranspiration, and (3) the timing of start of the recharge season is changed after harvest. In addition, typical values of the aquifer parameter for different types of glacial-lacustrine deposits must be determined for use in the hydrogeological portion of the model. Further development of the model as a screening tool is not recommended until *after* the hypothetical linkage between forest practices and wet season groundwater storage is empirically substantiated. The proposed research should determine the harvest-groundwater storage effect in several basins where glacial sediments and climate are the most conducive to such effect. If no effect appears in these basins, then conclusion can be drawn that no effect is likely to be found in *any* (emphasis added in original) basin dominated by glacial sediments. The model may be useful for finding suitable sites for such experiments.

The Forest Practices Board, DNR, AMP and CMER continued the development of tools to identify and address unstable slopes through efforts such as the Regional Landform Identification Project and the Landslide Hazard Zonation project. Additional information can be found at www.dnr.wa.gov.^{vii}

2.3 Hazel Watershed Analysis ²⁴

Background

The Hazel WAU is located in Skagit and Snohomish counties approximately 15 miles northeast of Arlington and 10 miles west of Darrington on the north side of the North Fork Stillaguamish River. The WAU contains approximately 24,800 acres of forested lands.

The Hazel WSA was initiated on October 18, 1994, through the publication of legal notices in newspapers and letters to interested parties. DNR Forest Practices staff from the department's

^{vii} DNR website, Adaptive Management Program,
http://www.dnr.wa.gov/BusinessPermits/Topics/FPAdaptiveManagementProgram/Pages/fp_am_program.aspx

Northwest Region Office and Forest Practices Division led the WSA. The initial DNR coordinator was Dan Pugmire, followed by Jeff Grizzel beginning in 1997.

Hazel Watershed Analysis Summary Timeline

10/18/1994	Hazel WSA Level 1 began with a public notification to interested parties and legal notices in newspapers.
1/1995	Assessment, causal mechanism reports and prescriptions completed.
9/1995	Technical (peer) review of Level 1 assessment documents completed.
12/1995	Revisions completed from technical (peer) review comments
1996	Staff changes result in little progress on WSA
3 and 4/1997	Prescription team meetings reconvened, including review Level 2 draft groundwater recharge (GWRA) prescription which refers to Miller Sias study.
5 to 9/1997	Alternative prescriptions reviewed by Forest Practices. DNR developed prescription and assembled package for SEPA review.
9/23/1997	Non-project Determination of Non-significance (DNS) signed. SEPA comment period begins.
2/4/1998	Modified DNS issued reflecting updated large woody debris prescriptions.
	SEPA comments received for GWRA and large woody debris (LWD) prescriptions.
5/12/1998	Notice of Action issued adopting WSA prescriptions.
6/10/1998	Arbor Pacific appealed Notice of Action to the FPAB (FPAB 98-21). Identified issue- ARS #2 prescription.
6/17/1998	Tulalip Tribes appealed Notice of Action to FPAB (FPAB 98-23). Identified issues ARS 13, 14, 15, and 16 (LWD) prescriptions.
7/21/2000	Appeals dismissed by FPAB based on Forest and Fish Emergency Rules.

Grizzel's email, sent 10-17-1997,²⁵ summarizes the history of Hazel WSA, and FPABs-21 and 23;²⁶ (see pg. 216: Memo to prescription team from Grizzel, 4-2-97) and a draft of the groundwater recharge area (GWRA) prescription);²⁷

The analysis was completed using version 2.1 of Board Manual Section 11, dated November 1994.²⁸ Participants included representatives from the following organizations:

Dan Pugmire – DNR Northwest Region Forest Practices, WSA coordinator pre-1996
 Jeff Grizzel – DNR Science Team, WSA coordinator 1997-1998
 Todd Thorn – DNR Northwest Region Forest Practices Forester
 Bob Penhale – ECY
 Paul Kennard – Tulalip Tribes
 Jay Guthrie – DNR state lands
 Ken Osborne – Grandy Lake

Mass Wasting Assessment Module and Prescriptions

This investigation focuses on the mass wasting assessment regarding the Hazel landslide, prescriptions, and the implementation of the prescriptions. The Hazel WSA includes many other assessment modules that are outside the scope of this investigation.

Level 1 Assessment

The initial Level 1 assessment report and causal mechanisms were completed in January 1995. Appendix A contained the mass wasting assessment work and was completed by Jerry Thorsen. Thorsen was a contracted specialist with G.W. Thorsen & Associates of Port Townsend, and was listed by DNR as a qualified analyst for conducting Level 1 and Level 2 mass wasting modules of WSA. Thorsen also was involved throughout the FPA 1919420 process described in Section 2.1 of this investigation, and a co-author of the 1988 Benda report¹⁷. The Level 1 assessment includes an overall description of the geology, information regarding each watershed sub-basin, individual map unit descriptions, and a description of the methods, confidence and recommendations as was required by rule and Board Manual.

Mass Wasting Map Units (MWMU) are grouped together by category and assigned a unique number. MWMU information is summarized using descriptions in Appendix A of the Hazel WSA. The Hazel landslide is one of four active, deep-seated landslides included in MWMU 1. Each of the four active, deep-seated landslides were given a sub-number: MWMUs 1-1, 1-2, 1-3, and 1-4. MWMU 1-2 is the Hazel landslide, described as “very large, very active, deep-seated slide”.²⁴ The WSA report states that the “active slide can, in most cases, be delineated with considerable confidence.” The landslide is described as being influenced by the river and the groundwater recharge area above the landslide. The landslide area includes glacial outwash sand and silt overlying lakebed silt commonly referred to as “blue clay.” The Level 1 assessment cites sensitivity to: “Upstream timber harvest can increase peak flows. Harvest on the slide or in its groundwater recharge area, can increase local groundwater. Roads can import runoff and increase local recharge.”^{viii}

MWMU 2 identifies the “hypothetical” groundwater recharge area of the deep seated landslides in MWMU 1. The assessment (Thorsen) describes these as:

MWMU 2 was essentially created by the Synthesis Team, with the outlining of individual recharge polygons on the map assigned to the MW Module Team. Whereas the active slides can, in most cases, be delineated with considerable confidence, the outlining of their recharge areas is fraught with uncertainty. (Obviously, if they could be reliably mapped they wouldn’t be “indeterminate”.) Resolving the uncertainty is not part of the Level 1 analysis.

^{viii} Endnote 23: Appendix A, Page A-16

It should be emphasized that there is no right or wrong, correct or incorrect, solution to the delineation of the recharge area for a particular landslide short of installing and monitoring an extensive field of test wells.^{ix}

The Hazel landslide at river mile 20 is the only one of the four large active landslides in MWMU 1 that has been previously been studied (Benda and others, 1988). During the course of that study two recharge areas were identified. I considered it beyond the scope of this Level 1 analysis to attempt to second guess that work.^{24, x}

The mapped boundaries of MWMU 2 are included in the Level 1 assessment and are assigned the same sub-numbering system as MWMU 1. The groundwater recharge area of the Hazel landslide is MWMU 2-2 and reflects the boundary delineated by Benda (1988) as part of the events surrounding FPA 1909420.

The mass wasting summary tables for MWMU 2 identify the Delivery Hazard Rating as “Indeterminate”. An “indeterminate” rating is discussed in the previous section (see WSA overview), and requires a Level 2 assessment.

Draft prescriptions were implemented by DNR during the period of time between the Hazel Level 1 assessment and completion of the Level 2 assessment. Causal mechanism and prescription documents dated January 1995²⁹ for MWMU 2 established the interim prescription: “No forest practices which reduce live vegetation and increase groundwater recharge within MWMU #2 will be allowed until Level 2 analysis is completed.”

Level 2 Assessment

Pursuant to the “indeterminate” rating and the recommendations of the Level 1 assessment team, a Level 2 assessment was commenced. It was determined that the scope of the Level 2 assessment was specific to the groundwater recharge area above the Hazel landslide, identified as MWMU 2-2. The final work of the Level 2 analysis team was led by Jeff Grizzel (Forest Practices Science Team). Manual Section 11 version 2.1 Appendix A describes the standard methods for a Level 2 assessment of mass wasting.^{28 above}

Seven methods are identified for potential use in Level 2 assessments to “improve the analysis to better address the critical questions or resolve uncertainties”^{xi}.^{28 above} Examples include:

- Expand and improve mapping using additional aerial photo interpretation and extensive field verification.
- Obtain a better understanding of deep-seated failures. Field check features affecting streams.

^{ix} Endnote 24: Appendix A, Page A-7 A.2.2

^x Endnote 24: Appendix A page A-8 A.2.2 MWMU 1-2 and 2-2

^{xi} Manual Section 11 version 2.1 page A-24 and 25

The manual further states “the report must document the results of the analysis, and provide sufficient information to support the decision criteria and potential-impact ratings.” In 1996, under contract between ECY and the Tulalip Tribes, a study was commissioned to inform the Level 2 analysis process. The Tulalip Tribes hired Dan Miller of M2 Environmental Services in Seattle to conduct the study. Miller was listed by DNR as a qualified analyst for conducting Level 1 and Level 2 mass wasting modules of WSA. The initiation of further study related to the Level 2 process is documented in:

- A March 20, 1995, memo from Paul Kennard (Tulalip Tribes) to Bob Penhale (ECY), Ken Osborn (Grandy Lake), and Jay Guthrie (DNR state lands)., which refers to Dan Miller’s proposal on deep-seated stability analysis – Hazel WAU.^{xii}
- An undated *Proposed Investigation of Deep-Seated Landsliding for the Hazel Creek Watershed Administrative Unit* from Daniel J. Miller [²⁹]
- Bob Penhale recalled during his interview that ECY had grant dollars available (ECY contract number C9600040) to pay the Tulalip Tribes to hire Dan Miller for a study to inform the Level 2 assessment.

Although the undated study by Miller, D. and Sias, J., *Environmental factors affecting the Hazel landslide*, refers to itself as a “Level 2 Watershed Analysis,” in fact a Level 2 assessment is characterized by proper completion of the WSA process and a duly promulgated SEPA decision by DNR. The Miller publication should accurately be referred to as a scientific study which informed the completion of a Level 2 assessment, not a Level 2 assessment itself.

The Manual Section 11’s suggested methods do not contemplate a study of the type that was completed by Miller and Sias. “Obtain(ing) a better understanding of deep-seated failures” was a suggested component of Level 2 assessments, but the suggested methods include analyses much less complex than Miller’s. For example, the Manual suggests time-series, aerial photo interpretation or other means of correlating relationships between land use and the initiation of slope movement, along with field verification.

Versions of the Miller and Sias study are available from various sources on the internet. However, an “official” copy of the final manuscript is not present in the DNR WSA file and does not appear to have been published. Copies of draft versions of the document, such as those that underwent peer review, are not available in the record. None of the electronically available versions are dated more precisely than “1997.” Miller and Sias did publish *Deciphering large landslides: linking hydrological, groundwater and slope stability models through GIS* in the journal *Hydrological Processes* in 1998. The article contains citations to the Hazel Level 2 analysis information and figures.

Dave Parks (Forest Practices geologist) completed the technical (peer) review³⁰ of the draft paper that Miller and Sias produced for the Hazel Level 2 analysis. Parks’ comments included various

^{xii} Page 453 03.pdf document does not contain the attached proposal that is referenced in Endnote 28

questions about Miller and Sias' modeling, assumptions and conclusions, such as (page numbers presumably refer to the manuscript Parks was reviewing):

Page 3 & 4, Site Characterization: How you define the ground water recharge area should be more explicit. It would be helpful to show the maximum possible area of the recharge area and the area your modeling covered.

Page 5, 3rd paragraph, dealing with horizontal position of the sand/clay contact. Has there been any significant post-glacial deformation or tilting that could influence the position of the sand/clay contact?

Page 11, 1st paragraph, 1st sentence, "This map of sensitivity indicates that certain portions of the landslide will respond to changes in recharge differently than others: many areas are unaffected, others experience a substantial decrease in stability.

The referenced map (Figure 7) shows relative decrease in calculated factor of safety which represents *potential sensitivity*. Later in the paper you discuss how the observed behavior of the landslide correlates with your model. However at this point, you are really displaying factor of safety calculations, not actual landslide sensitivity or behavior.

Hazel WSA records establish that the Miller and Sias report was considered and reflected in the final WSA adopted in 1998. The earliest documentation of prescription team deliberations are draft prescription documents sent to the team on April 2, 1997, by Jeff Grizzel. The draft prescriptions included reference to the Miller and Sias paper^{xiii 26, 31} Jay Guthrie recalled during his interview that Dan Miller made a presentation to the prescription team regarding his study. The presentation is also referenced in an undated *Hazel Watershed Analysis Chronology* document. An on-screen presentation was used during the prescription team discussions but does not exist in the record.²⁷

The final ARS Number 2 prescription document²⁴ incorporated the Level 2 assessment information by:

- "Resource protection objective indicates: Forest practice activities should produce no decrease in the factor of safety within the potentially active portion of the associated landslide (MWMU #1). Note: The baseline or "background" factor of safety should be determined for current topographic, canopy, and river conditions. Identifying the potential active portion of the landslide will require field reconnaissance/mapping as part of the factor of safety evaluation (described below).
- Prescription: A detailed, site-specific operation plan shall be developed for any proposed forest practice activity within thin MWMU. The plan and associated activity shall meet the resource protection objective stated above. The proposed forest practices activity shall be evaluated to determine if and to what extent the operation results in a change in the factor of safety within the associated deep seated landslide (MWMU #1). The evaluation

^{xiii} Endnote 25: page 216 box 01a.pdf

shall follow the methods established by Miller and Sias (1997)^{xiv} or an equivalent or better method. The evaluation shall explicitly define, describe, and map the groundwater recharge (MWMU #2) and potentially active portion of the landslide (all or part of MWMU #1). The forest practice application package shall include a detailed report describing the results of this evaluation and a statement confirming the operation meets the above stated resource protection objective. In addition to the factor of safety analysis required above, a monitoring plan shall be developed and implemented in conjunction with any proposed forest practice activity. The plan shall be implemented for a minimum of five years, although a period of 10 years is recommended. The plan shall include, at a minimum, the following monitoring parameters:

1. A record of daily precipitation at or in close proximity to the site;
2. A record of monthly groundwater levels at a point with the groundwater recharge area.

It is recommended that monitoring of stream discharge on Headache Creek and daily precipitation be carried out in order to better calibrate the hydrologic model that is part of the overall slope stability (factor of safety) evaluation.

Citation: Miller, D and J. Sias. 1997. Environmental Factors Affecting the Hazel Landslide Level 2 Watershed Analysis, Hazel, Washington. Unpublished report. M2 Environmental Services, Seattle, WA.

Meeting notes, agendas and communications from Grizzel indicate that changes to the map boundary of MWMU 2-2 were considered by the prescription team during meetings in early 1997. Penhale concurs in his interview that the prescription team agreed to implement the Miller process in the prescriptions, but that the map generated from the Level 1 assessment (Benda) was not changed by the Level 2 assessment work (Penhale interview).³² Prescription team participants interviewed for this report did not provide additional information about what factors were considered in arriving at the final prescription.

Approval of Final WSA

The final WSA prescription document was circulated to agencies and participants per WAC 222-22-080 and public notice and review was conducted following SEPA. DNR was the lead agency for SEPA. A distribution list was used to identify agency and individuals that would receive a copy of the documents via mail.²⁹ The action was signed by DNR on September 23, 1997, entered into the DNR SEPA Center data base and forwarded to the ECY SEPA Center for entry into the statewide SEPA register, beginning the SEPA comment period. The ECY SEPA register was available to the general public. The Tulalip Tribes notified DNR on September 29, 1997 of their concerns with the riparian prescriptions, indicating that details would be submitted during the SEPA comment period. SEPA comments²⁹ were received and included^{xv}:

^{xiv} Miller, D and J. Sias. 1997. Environmental Factors Affecting the Hazel Landslide Level 2 Watershed Analysis, Hazel, Washington. Unpublished report. M2 Environmental Services, Seattle, WA. (Document Unavailable), Noted in Endnote 23. Hazel Watershed Analysis, Areas of Resource Sensitivity 2, MWMU #2, Page P-3.

^{xv} Endnote 29: Hazel WSA DNR coordinator box, pages 258-259, 266-279

Jay Guthrie – (DNR state lands) Regarding soil disturbance language in ARS 12.

Ken Osborn – (Grandy Lake) Regarding “overly restrictive prescription for the water recharge area above the Hazel Slide.”

Additional comments were not received from the Tulalip Tribes, who instead chose to meet directly with DNR staff.

The initial comments were considered by DNR in proposing a new Hazel Watershed Unit Prescription document dated December 5, 1997. These were distributed in a memo to interested parties on January 29, 1998, summarizing the modifications as:^{xvi}

The DNR decided to modify the large woody debris prescriptions (dated September 15, 1997) included in the original SEPA package. All other prescriptions remain the same as in the earlier version. The modifications resulted in the creation of a new ARS and a renumbering of the old ARS beginning with No. 12. This increases the total number of ARS in the WAU to 19.

The memo triggered a second public notice and SEPA comment period which began February 24, 1998. SEPA comments were received and included:

Jay Guthrie (DNR state lands) regarding large woody debris (LWD) prescriptions

The Tulalip Tribes regarding LWD in the riparian prescriptions

Ken Osborn (Grandy Lake) regarding the process used by DNR to develop prescriptions for the Hazel landslide groundwater recharge area and riparian management zones (specific reference to ARS 2, 13, 14, 15, and 16).^{xvii}

The final Notice of Action was issued on May 18, 1998, resulting in approval of the WSA prescriptions. The Notice of Action was added to the SEPA Register and a legal notice also appeared in Skagit County newspapers.²⁹ The Notice of Action provided a 30-day appeal period. Two appeals were filed before the FPAB:

- FPAB number 98-21 Grandy Lake Forest Associates (6/10/1998)
- FPAB number 98-23 Tulalip Tribes of Washington (6/17/1998)

The FPAB combined the two appeals. In general, the Tulalip Tribes requested that DNR adopt wider riparian buffers that provided more LWD. Grandy Lake requested the opposite approach while also challenging the ARS 2 groundwater recharge prescription for the Hazel landslide. While the appeals were pending, the state legislature passed the 1999 Salmon Recovery Act and the Board initiated emergency rulemaking to adopt the new requirements. Both appeals were dismissed by the FPAB on July 21, 2000, which stated that the remaining appeal issues were

^{xvi} Endnote 29: Hazel WSA DNR coordinator box, 03.pdf, pages 342 and 308-334

^{xvii} Endnote 29: Hazel WSA DNR coordinator box 03.pdf, pages 470-475; DNS (9/29/1997): page 258; MDNS (1/29/1998): page 340.

moot due to the Board's promulgation of emergency Forests & Fish rules. The March 2000 Emergency Rules WAC 222-22-070(3) stated:

The forest and fish emergency rules, when effective, supersede all existing watershed analysis riparian prescriptions with the exception of riparian management zones for exempt 20-acre parcels, when watershed analysis prescriptions were in effect before January 1, 1999. No new riparian prescriptions will be written after completion of the riparian management zone assessment report during a watershed analysis.

Approved Prescriptions

The Hazel WSA prescriptions were in place beginning May 18, 1998. Mass-wasting prescriptions remained in effect until August 9, 2013. In the vicinity of the Hazel landslide these included ARS numbers 1, 2, 3, 4, 5, 6, and 9. The ARS No. 2 prescription for the groundwater recharge area was considered non-specific because the prescriptions required additional study. This means that FPAs which proposed activities within ARS No. 2 would be classified as Class IV-Special and require SEPA review whereas those that avoided activities within ARS No. 2 would be a Class III FPA and not require SEPA (see Appendix A for additional information on FPA classification).

The final prescription document added a section on "Map Resolution Issues,"²⁴ which included:

...in some cases, areas of potential landslide hazard may not have been identified accurately due to: (1) the dependence on remote-sensed data (i.e., aerial photos); (2) the relatively short (50 years) and unique history of storms that triggered landslides used in delineating mass wasting units; and (3) the incomplete scientific understanding of all landslide mechanisms. For all these reasons, map units developed during this analysis may not capture all potentially unstable areas. Conversely, there may be inclusions of stable, low hazard areas within mapped units that do not meet the written description of the mass wasting units. As a result, implementation of prescriptions requires the identification of mass wasting unit boundaries in the field. The identification and field verification of map unit boundaries can be accomplished by foresters or other resource managers using the descriptions included in the mass wasting assessment report.

In this way, the proximity of an FPA to ARS units was an initial screen to determine the potential applicability of prescriptions. All map unit boundary locations were subject to field verification. The "descriptions included in the mass wasting assessment report" that defined the boundary of MWMU 2-2 was the slight topographic break separating the area "directly upslope" from the landslide.

2.4 Conclusions

The scope of this investigation was to describe the regulatory requirements in place at the time of FPA decisions and how those requirements were developed, including the Hazel WSA.

The final Hazel WSA reflects both the Benda (1988) and Miller and Sias (1997) studies. The Miller study was considered by DNR and the prescription team in the development of final maps and prescriptions for the Hazel landslide groundwater recharge area (ARS No. 2, MWMU 2-2). The team did not recommend that DNR replace Benda's delineation of the potential Hazel landslide groundwater recharge area with the boundary that was generated by the Miller study's computer model outputs. The record lacks information about what factors may have been considered in this decision, and no further clarity was provided by interviews with the team participants. However, a science review was subsequently commissioned (2000) by CMER to evaluate the use of the Miller study's method for delineating groundwater recharge areas statewide. The review cited areas of scientific uncertainty and recommended against the use of this method until uncertainties could be resolved.

The final prescription for MWMU 2 required that any forest practice activity proposed to take place within the map unit boundary should be analyzed using the Miller study's methods. FPAs that proposed harvest outside the boundary of MWMU 2 did not require this additional study.

The Hazel WSA required that map unit boundaries were verified in the field by foresters or other resource managers, citing potential inaccuracies and limitations of the mapping.

FPA's are reviewed in a two-step process prior to an approval or disapproval decision by DNR. This includes office review for content and initial resource screening followed by field staff review. Staff use available tools to evaluate the FPA including paper maps, geographic information system (GIS) based maps, landowner-provided information, and field analyses using professional training, experience and local knowledge. Appendix A contains additional information on the FPA process.

This map displays the SR530 Landslide Area, showing the approximate extent of the landslide (shaded green) and the locations of the FPA (shaded yellow). The map includes a grid of section numbers (e.g., 25, 26, 27, 30, 31, 34, 35, 36, 3, 2, 1, 6, 10, 11, 12, 7, 13, 14, 15, 18) and labels for the North Fork Skagway River and Skagway Creek. The map is divided into four quadrants by a red line, with labels T33R07E, T33R08E, T32R07E, and T32R08E. A legend at the bottom left indicates that yellow shading represents FPA Locations and green shading represents the Approximate SR530 Landslide Extent. A scale bar at the bottom right shows distances from 0 to 1 mile, and a north arrow is located at the bottom right corner.

3.1 2004 Grandy Lake FPA 2806934 and 2807020

FPA 2806934 Summary

Approximately fifteen years after the FPA 1909420 appeal settlement and six years after the Hazel WSA was completed, Grandy Lake submitted FPA 2806934. The FPA proposed a 15-acre, even-aged harvest within the southwest quarter of Section 1, Township 32 North, Range 7 East. The application was disapproved on July 27, 2004, because the necessary information was not included to approve harvest within the Hazel WSA according to the prescription required for ARS No. 2. The FPA was considered incomplete. The proposal was resubmitted as FPA 2807020 showing the deletion of harvest within ARS No. 2 and was approved on August 23, 2004.

FPA 2806934 Details³³

FPA 2806934 was submitted by Grandy Lake to the DNR Northwest Region Office on June 28, 2004. The application proposed a 15-acre, even-aged harvest within the southwest quarter of Section 1, Township 32 North, Range 7 East. The steepest slope within the harvest area noted on the application was 10 percent.

Forest Practices office staff identified Hazel WAU, Hazel landslide settlement agreement, special animals, Federal endangered and threatened animal species, and water-right information as potential concerns listed in the TRAXS database. The Hazel WSA maps were used to identify the potential prescription requirements that may be needed for an individual FPA.

Forest Practices staff identified that the FPA was within the Hazel WSA and the ARS No. 2 prescription was applicable. The prescription identifies the level of information needed for a specific activity to be conducted^{24, xviii}.

The application was initially classified by office staff as a Class III with a 30-day decision time period. A Class III application does not require SEPA review. Reviewers are provided a minimum of 14 days to comment on a proposal. The Forest Practices staff takes into account any comment received about a proposal, even after the FPA is approved. The record does not indicate why the application was initially accepted and classified by office staff without the Hazel WSA ARS No. 2 prescription's specific information requirements.

The FPA was distributed to WDFW, ECY, affected Indian Tribes, local governments, and other interested parties.³³ There is no record of the Forest Practices receiving any comments on the FPA.

The landowner's representative, Ken Osborn of Arbor Pacific, provided an email to Todd Olson, Northwest Region Forest Practices forester, documenting a field meeting that occurred on June 23, 2004, to review the proposed harvest^{xix} "on the plateau not far from the Hazel slide".³³

^{xviii} Endnote 24: DNR, Hazel Watershed Analysis assessment and prescriptions (undated)

^{xix} Endnote 33: Email from Arbor Pacific to Todd Olson cc Dan Miller dated June 25, 2004, 10:12 am, indicates that the site visit occurred before the FPA was submitted.

The meeting included Osborn, Dan Miller, and Pat Stevenson, a representative of the Stillaguamish Tribe. Each of these individuals participated in the Hazel WSA process. DNR's documentation does not indicate if Region Forest Practices staff were invited to the pre-submittal site visit. [References ³², ¹² The email further states:

I have requested Dan Miller to give me a proposal for: first, assessing water contribution to the slide if we were to harvest 3 acres on the plateau above the slide, since this is the most sensitive part of our proposal.³⁴

The balance of the proposed harvest area appears to be in the recharge area of neighboring Headache Creek. Dan Miller feels a further study of possible the (sic) water contribution to the slide from this sub watershed is also necessary. This would require some kind of probes to be set up within the berm separating Headache Creek the slide (sic)."

The email also states:

"The entire area is entirely (sic) on the flat bench."

and

"The primary contributor to slide destabilization is the river, as it eats away at the toe of the slide."

The email concludes with: "Dan Miller is being copied on this correspondence in case he wishes to elaborate/amend any of the above." No further correspondence from Miller exists in the record regarding the FPA.

In this communication, Osborn acknowledges that a portion of the initially proposed harvest may affect groundwater recharge and would require additional study. He requests that DNR approve the application in spite of this, suggesting that the FPA could be approved on the condition that harvest would not proceed until the completion of further study.

Osborn recalls in his interview that Miller provided him a monitoring proposal for the groundwater recharge area (ARS No. 2 of the Hazel WSA). Osborn stated that he submitted the first FPA knowing that FPA included ARS No. 2 and wanted to know how the FPA process would work. Osborn stated that the field visit may have resulted in marking some locations of groundwater recharge area edge but doesn't recall specifically.

DNR documents include an undated report from Daniel Miller and Lynne Rodgers Miller titled *Timber Harvest on Whitman Bench above the Hazel Landslide*. Microsoft Word file document properties indicate that the document was created July 11, 2004, by Dan Miller.³⁴ Based upon the creation date, reference to "A portion of the harvest unit lies within the groundwater recharge area estimated by level 2 watershed analysis," and Osborn's June 25, 2004, email to Olson, the document appears to have been prepared for Grandy Lake to evaluate the cost of proceeding with their harvest proposal. The document further states:

Using the prior observations and modeling (Miller and Sias, 1997) as a guide for the analysis, we can identify two primary issues:

- To what extent does groundwater flow from the Headache Creek basin to the Hazel landslide? Based on groundwater modeling in the previous study, the water-table divide separating groundwater flow between the Headache Creek basin and the Hazel landslide lies north of the topographic divide. Therefore, a portion of the drainage area to Headache Creek, based on surface topography, provides groundwater recharge to the landslide. If this is true, then any harvest in that area (see the orange polygon in the figure below) can potentially cause an increase in groundwater recharge to the landslide, with a consequent reduction in calculated factors of safety. However, subsurface stratigraphy beneath the topographic divide may effectively block groundwater flow into the landslide. Both Headache Creek Basin and the landslide lie on separate large, old, dormant, down-dropped landslide blocks. Intact stratigraphy separating the blocks may provide a clay layer that acts to block groundwater flow across the topographic divide.
- What is the magnitude of fluctuations in water-table level on the landslide? Both field observations and the previous modeling suggest that portions of the landslide block are entirely saturated to the ground surface every winter. The extent of this saturated area has great implications for slope stability, because factor-of-safety variations within this zone are minimal. Field monitoring could better establish the extent of this zone. If groundwater flow from the proposed harvest area is restricted to the zone of perpetual winter saturation, then harvest would have no effect on the factor of safety.

Neither Olson nor Garth Anderson (DNR Northwest Region Forest Practices geologist) recall receiving the monitoring proposal document during the application process.

Olson and Anderson recall visiting the site after the FPA was submitted, although accounts differ as to whether Osborn attended. The Forest Practices field review took place between the FPA submittal (June 28) and Olson's letter notifying Grandy Lake (July 26) of the FPA's disapproval. The site visit was not documented in the record and the specific timing of the visit and any additional attendees are not clear.³²

Olson recalls the site visit reviewing the FPA as a broad flat area, and that Anderson determined the location of the proposed harvest was within the groundwater recharge area (ARS No. 2). Olson remembers looking at the scarp of the old slide and working back towards the harvest proposal.³²

Anderson recalls that he walked the eastern FPA boundary along the slope break above Rollins Creek. Anderson did not perform a reassessment of the mapped edge of the groundwater recharge area, but did determine that the proposal was within ARS No. 2. Anderson indicated that the Hazel WSA ARS map was used for ARS No. 2 identification. He remembers that Olson also wanted to look at the top of the landslide scarp.³²

The decision to disapprove the FPA occurred on July 27, 2004. The Notice of Decision dated July 2, 2004, states: "Disapproval per letter from Forest Practices Forester dated 7/26/2004." The letter states:

The FPA is considered incomplete since it does not include a detailed report, which is to incorporate evaluations relating to the proposed activities within Area of Resource Sensitivity No. 2 of the Hazel Watershed Analysis Prescriptions. In addition, a monitoring plan was not included as per the prescription requirements.

The aforementioned issues should be addressed if you choose to resubmit the FPA under its current proposed site boundaries. [Footnote: FPA 2806934; Notice of Decision dated July 27, 2004 and Todd Olson letter dated July 26, 2004.]³³

FPA 2807020 Summary^{33 35}

Grandy Lake submitted a revised proposal July 23, 2004. The application proposed 7.5 acres of even-aged harvest, which explicitly excluded the ARS No. 2 groundwater recharge area of the Hazel landslide. FPA 2807020 was approved on August 23, 2004, and expired August 23, 2006.

FPA 2807020 Details

FPA 2807020 was submitted by Grandy Lake to the DNR Northwest Region Office on July 23, 2004, as a resubmittal of FPA 2806934. The resubmittal occurred four days prior to the date of the disapproval decision on FPA 2806934. There is no information in the record indicating why Grandy Lake chose to resubmit prior to receiving the decision to disapprove.

The application proposed 7.5 acres of even aged harvest that excluded the area within the mapped ARS No. 2 boundary for the groundwater recharge area of the Hazel landslide. The FPA stated: "This version excludes the area underlain by ARS #2 of the Hazel Watershed Analysis. A yellow flag line is now the interior boundary (new unit boundary)."

The FPA activity map illustrates the location of the "yellow ribbon" in relation to the mapped ARS No. 2 boundary. The timber harvest section of the FPA (application questions 1 and 3) states that the steepest slope within the harvest area is less than 10 percent and that timber harvest will not occur on potentially unstable slopes.

The Forest Practices office review identified Hazel WAU, Hazel landslide settlement agreement and other information generated by the TRAXS system. The proposed harvest was identified as having been within the Hazel WSA but not impacted by any Hazel WSA Prescriptions per information provided by the applicant in question 23 of the FPA^{xx}.³⁵

Grandy Lake's FPA was processed as a Class III with a 30 day decision time period. The application was not a Class IV-special because it implemented applicable Hazel WSA prescriptions by proposing harvest outside of ARS No. 2 (WAC 222-16-050(1)(d) and WAC 222-22-090(e)).

The FPA was distributed to WDFW, ECY, affected Indian Tribes, local governments, and other interested parties.³⁵ Forest Practices staff received one comment via phone from the Sauk-

^{xx} Endnote 35: DNR, FPA 2807020, Office Checklist, TRAXS report

Suiattle Tribe regarding ground disturbance and road construction within the vicinity of an old homestead. A homestead may be considered a cultural resource per the definition in WAC 222-16-010 “cultural resource”^{xxi}.³⁵ Olson communicated with Northwest Region Forest Practices staff on Aug 20, 2004, to indicate that the cultural resource issue has been resolved. No other detail is provided except one email from the landowner to Olson stating that a conversation had taken place between with a tribal representative and a “go ahead” was received^{xxii}.]³⁵ Author’s 2014 review of data from the Office of Archeology and Historic Preservation did not indicate any known cultural resources sites within the FPA area.

The FPA activity map indicates that yellow flagging was used as the harvest boundary and the location of the groundwater recharge area. Interviews with Osborn, Miller, and Stevenson were³² not conclusive regarding how the line was identified, who identified the line, or when the line was identified. Each account corroborates that a site visit took place before FPA 2806934 was submitted. Stevenson recalls Osborn stating that he hired someone to put the line in. Osborn stated that some of the locations of the groundwater recharge area edge may have been marked during the pre-submittal site visit, but didn’t recall specifically. Osborn went on to say that surface topography was used to estimate where the underlying geology would slope. He recalled looking for very slight sloping in different directions to estimate edge of the groundwater recharge area. Neither Osborn, Stevenson, nor Miller indicate that they performed another site visit after the disapproval of FPA 2806934.³²

The record and accounts of Forest Practices staff do not indicate another site visit occurred by DNR before the proposal was approved.

The FPA was approved using a Notice of Decision dated 8/23/2004.³² The FPA expired on August 23, 2006. Additional approval conditions were placed on the FPA, summarized as:

- Required 48 hour notification prior to operations.
- Limit soil rutting or soil displacement.
- Yarding and hauling limitation during rain.
- Follow the written agreement with Sauk-Suiattle Indian Tribe regarding cultural resource protection.
- FPA and any enforcement documents required to be possessed on site.

Post approval information

The landowner provided two notification to region staff that operations will be starting per the FPA conditions’ requirement of 48-hour notification, once on September 16, 2004, and again on October 1, 2004.

Olson conducted a field inspection on October 26, 2004, indicating that the harvest was “done; in compliance and needs reforestation”. Hand-written Forest Practices field compliance sheets^{xxiii}

^{xxi} Endnote 35: undated email from Jan Daly to Todd Olson

^{xxii} Endnote 35: email from Arbor Pacific Forestry Services Inc. to Todd Olson dated 8/23/04 7:42am

^{xxiii} Typed FP-Site Review/ Compliance Log states Harvest done; needs reforestation. Hand written Forest Practices Field Compliance states Harvest done- in compliance

were used at the time and were included in the region FPA file.³⁵ Olson recalled the field inspection in his interview and stated that the FPA was in compliance. No other specific details regarding the visit are available. Documentation does not indicate what specific aspects of the FPA were reviewed, but no violations of the FPA or the Forest Practices rules were found.

Conclusions

The record indicates the approval of FPA (2807020) was in compliance with the rules. The resubmitted proposal stipulated it would avoid ARS No. 2 and therefore did not trigger the prescription's requirement for further study. No other comments or information were submitted to DNR during the application decision period that would have warranted disapproval.

The primary factors determining the harvest's compliance with the Forest Practices rules are the location of the harvest boundary flag line in relation to ARS No. 2, and whether the harvest itself exceeded this flagged area or in some other way failed to comply with the FPA.

Location of Harvest Boundary Flag Line

The final Hazel WSA specifies that map unit boundaries were to be field-verified (see Section 2.3). The WSA expectations were that the identification and field verification of map unit boundaries can be accomplished by foresters or other resource managers using the descriptions included in the mass-wasting assessment report. The description included in the Hazel WSA mass wasting assessment report that defined the boundary of MWMU 2-2 was the topographic break separating the area "directly upslope"²⁴ from the landslide. The applicant is expected to perform this delineation when an FPA is situated immediately adjacent to a mapped boundary. In this case, the applicant was responsible for locating the Benda-mapped boundary or the area "directly upslope" from the landslide that depicted the boundary, if there was in fact a difference between the two. While the record is unclear about when, how, and by whom the line was installed, it was known that three people knowledgeable about the WSA (Osborn, Miller and Stevenson) completed a site visit to review groundwater recharge area issues.

The activity map submitted with the FPA does not by itself determine compliance. Activity maps are designed to give a general location and features associated with harvest proposals, but are not required to be precise. Applicants utilize symbology and map scales that are coarse estimates, and DNR office staff manually digitize these for inclusion in the department's GIS data layers. The precision of both the activity map itself and the subsequently digitized representation is limited. Based on the activity map scale, the width of the map symbols used on the FPA are approximately 100-feet wide. A line that is 100-feet wide and 1,000-feet long would equate to just over 2 acres in size.

Based on these factors, the compliance status of the harvest boundary flag line location relative to ARS No. 2 is inconclusive.

Harvest Compliance with Flag Line

Post-approval compliance visit documentation indicates the FPA was in compliance but does not further specify the extent of the site review. Accurately reestablishing the location of the 2004 flag line for purposes of comparison against the harvested area is not possible given the length of time since the harvest was conducted. Comparisons have been made by DNR and others using aerial photography showing the completed harvest and the digitized FPA activity map boundary. These do not demonstrate noncompliance with the approved FPA due to the previously listed factors relating to FPA activity maps and the WSA expectations of field-verifying ARS boundaries. However, the FPA estimated 7.5 acres to be harvested whereas calculations based on aerial photography indicate approximately 8.5 acres were harvested.

Based on these factors, the compliance status of the harvest with the installed boundary flag line also is inconclusive. However, the completed harvest is not in compliance with the approved FPA's harvest acreage.

3.2 Summary of Other FPAs in the vicinity of the Hazel landslide (1 mile)

2004 FPA 2807159

FPA 2807159 was submitted³⁶ on September 7, 2004, by DNR state lands staff and is located in Sections 25 and 36, Township 33 North Range, 7 East. This is approximately one-half mile northeast of the Hazel landslide area on the northeast side of Rollins Creek. The FPA proposed uneven-aged harvest of 272.5 acres in six harvest units, constructing 1.75 miles of road, and abandoning 1 mile of road. All but one harvest unit were proposed to leave 100 to 115 trees per acre standing following harvest, while the remaining unit (12 acres in size) proposed to leave 45 trees. SEPA review was not required by Forest Practice staff but was conducted by the landowner.

Jay Guthrie (DNR state lands) and Steve Ranten (Forest Practices forester) recalled a site visit occurred before FPA approval to review buffers along Rollins Creek and other tributaries. They are unclear about the specific attendees, timing, or conclusions reached as a result of that site visit.³²

Hazel WSA prescriptions were identified for the proposal and documented in the FPA materials. The FPA correctly identified ARS Nos. 3, 5, 9, 12, and 14.

The FPA was approved October 1, 2004, and expired October 1, 2006.

2006 FPAs 2808627, 2808815, 2808883

FPA 2808627³⁷ was submitted on August 7, 2006, and later withdrawn by Grandy Lake. It is located in Section 1, Township 32 North, Range 7 East and Section 36, Township 33 North, Range 7 East. The proposal included even-aged harvest of 26 acres and construction of 5,200 feet of temporary road. Grandy Lake withdrew the application resulting from a meeting on site

with Todd Olson (Forest Practices forester). ICN 10923 provided details of an August 10, 2006, site visit in which Todd Olson states:

On site review revealed that the submitted FPA includes areas within MWMU unit #6 (ARS#6) that have an uninterrupted slopes greater than 50 percent. These area are proposed for timber harvest in the FPA. The new road and road re-construction planned within ARS #6 was not staked in the field by a qualified engineer. As such, This FPA cannot be approved by DNR as submitted since the ARS prescriptions are not met in the proposal. The landowner may withdraw the FPA and resubmit the application after addressing the appropriate prescriptions for the ARS's # 5, 6, and 12^{xxiv}.³⁷

Ken Osborn requested to withdraw the FPA by letter dated August 29, 2006.

FPA 2808815 was submitted on October 26, 2006, as a resubmittal of FPA 2808627 and was also withdrawn by Grandy Lake. The proposal included an even-aged harvest of 80 acres and construction of 6,800 feet of temporary road. Grandy Lake withdrew the application as a result of a meeting onsite with Forest Practices staff. In a November 22, 2006, letter, the landowner states "We need to withdraw the above referenced FPA due to areas added to unit as per yesterday's on site ID Team".^{xxv}³⁷ No other information is available in the record about the issues associated with the withdrawal.

FPA 2808883 was submitted on December 5, 2006, as a resubmittal of FPA 2808815 by Grandy Lake and DNR state lands. The proposal included an even-aged harvest of 85 acres and construction of 6,800 feet of temporary road. Approximately half of the road work proposed in the FPA is located in Section 36, Township 33 North, Range 7 East and is on DNR-managed lands^{xxvi}.³⁷ This location is approximately one-half mile from the Hazel landslide area on the east side of Rollins Creek.

Hazel WSA prescriptions ARS Nos. 5, 6, and 12 were identified by DNR office staff for the proposal and documented in the FPA materials and the Notice of Decision. The applicant identified only ARS No. 6 on the FPA itself.³⁷

The FPA was approved on December 20, 2006, and expired December 20, 2008. FPA approval conditions included requiring a 48- hour notice prior to the start of operations, and:

The forest practice proposal is located in the Hazel WAU. The applicant has indicate that Area(s) of Resource Sensitivity (ARS) 5, 6, and 12 will be affected, and has indicated which prescription(s) they will use in conducting the forest practice activity in the ARS. Approval of this application is subject to 1) confirmation by the DNR that the prescription(s) selected by the applicant is one or more of the prescriptions approved for the specific ARS; and 2) that the use of these prescriptions are required.

Fell and yard timber away from all waters, wetlands, and buffers.

^{xxiv} Endnote 37: FPA 2808627 ICN # 10923 dated 8-10-2006 by Todd Olson

^{xxv} Endnote 37: Letter from Ken Osborn to Linda Utgard (DNR Forest Practices Staff) dated November 22, 2006

^{xxvi} Endnote 37: FPA 280883 questions 7, 9, 12, and activity map

Ground Based Operations: With the exception of road construction/stream crossings, no equipment will be allowed within 25 feet of any stream channel; no skid trails will be allowed within 50 feet of any stream channel; no ground based yarding on slopes greater than 30%; equipment will not operate on any wetland soils connected with the stream channels; at the conclusion of the operation, skid trail drainage shall be established at intervals not exceeding 200 feet; within 200 feet of any stream channel, skid trail drainage shall be established at intervals not exceeding 75 feet.

Operate ground-based equipment during periods of stable soil conditions. If excessive rutting or soil displacement occurs that may increase the potential of sediment delivery to any stream, stop yarding until acceptably dry conditions prevail, in consultation with the Forest Practice Forester.

A minimum of front-end suspension shall be utilized on all cable yarding operations. If the use of front-end suspension will not ensure the maintenance of stream channel integrity, full suspension yarding will be utilized.

Two post-approval compliance visits were completed by Todd Olson, the first on June 14 and June 27, 2007. The compliance log indicates repeated occurrences of water flowing over the road from beaver activity that caused a culvert to become plugged.^{32, 37} The record indicates the culvert was unplugged by the applicant twice in response to Forest Practices compliance visits, and that Forest Practices staff identified the need for a long-term resolution of the issue. Status of the long-term fix is not documented.

Forest Practices GIS mapping of the harvest boundaries do not replicate the area harvested on recent aerial photos. While the proposed total harvest acreage noted in the FPA is approximately correct, the applicant's activity map of Unit 2 is not drawn to an accurate scale and therefore comparing the FPA activity map to a post-harvest aerial photo gives the appearance that a larger area was harvested than was mapped. Based on a review of mapped stream locations and aerial photos, this appears to have resulted from the applicant's correct identification of additional streams and associated buffers that were not present on the Forest Practices hydrologic mapping GIS layer. However, the applicant's FPA activity map drew the additional streams in the wrong location, resulting in a map that is more compressed than the actual harvest location.

2009 FPA 2810523

FPA 2810523 was submitted³⁸ on March 16, 2009, by Grandy Lake and located in Sections 1 and 2, Township 32 North, Range 7 East. The proposal included commercial thinning and cedar salvage harvest on 240 acres and removing approximately 75 trees per acre.

Hazel WSA prescriptions were identified for the proposal and documented in the FPA materials. The harvest was identified by the applicant as being immediately adjacent to ARS Nos. 1, 6, and

12. The FPA states, “This unit is within the Hazel Watershed Analysis Unit. We have bounded out the water recharge area, as required^{xxvii}.”³⁸

The Hazel landslide groundwater recharge area was labelled on the activity map as ARS No. 1 instead of ARS No. 2. However, no activities were proposed within the recharge area or any other ARS.

Field review by Todd Olson before approval identified a concern with a non-perennial stream; the FPA was updated accordingly prior to the decision. The Forest Practices site review notes indicate that ARS No. 6 does not apply although the applicant identified this ARS.³⁸

Forest Practices approval conditions included requiring 48-hour notification prior to the start of operations, a 25-foot equipment exclusion on wetlands, the use of low-impact harvest equipment within unmapped forested wetlands, and³⁸

The forest practice proposal is located within the Hazel WAU. The proposed activities will be conducted within the mapped Area of Resource Sensitivity (ARS) #6. Approval of this application is subject to 1) confirmation by the DNR that the prescription is approved for ARS #6; and 2) that the use of the prescription for ARS #6 is required. The applicant has indicated that harvest activities will not be conducted within areas that are described in the prescription of ARS #6.

A field compliance check was conducted by Todd Olson during operations and identified no concerns. DNR received a 48-hour notice in advance of the commencement of harvest operations.³⁸

The FPA was approved on April 3, 2009. The applicant applied to renew the application, and the renewal was approved on April 3, 2011. The renewed FPA expired April 3, 2013.

A new resource concern was identified for peregrine falcon by Forest Practices and WDFW staff at time of renewal. In approving the renewal, Olson applied additional conditions to limit operations within one-half mile of the falcon nest between March 1 and July 30. The conditions achieve the level of resource protection required by rule to avoid impacts that would have required a Class IV-Special application and SEPA review.

2010 FPA 2811279

FPA 2811279 was submitted³⁹ on July 30, 2010, by Grandy Lake and is located in Section 1, Township 32 North, Range 7 East. The proposal includes commercial thinning using ground-based harvest methods and salvage using a helicopter on a total of 42 acres. Thirty percent of the total volume available was proposed for removal.³⁹ The location is approximately three-quarters of a mile from the Hazel landslide area, and approximately one-quarter mile east of Rollins Creek.

^{xxvii} Endnote 38: FPA 2810523 FPA question 13, 25, WSA worksheet, and activity map

Office staff confirmed proposed harvest did not contain any applicable Hazel WSA prescriptions^{xxviii}.³⁹

Todd Olson conducted a pre-approval field review, assisted by aerial photos and LiDAR. Clarifications were needed from the applicant regarding stream typing and wetland identification. The applicant submitted an amendment reflecting the identified changes to the FPA prior to approval^{xxix}.³⁹

Conditions on approval included requiring 48-hour notice prior to the start of operations and a requirement that cutting line boundaries are properly identified. Olson recalls using the cutting line boundary condition when there is a concern that boundary line flagging is not necessarily clear for ground operations.³⁹

A 48-hour notice in advance of commencing harvest operations was received. Olson conducted a compliance check during the operation and found no violations^{xxx}.³⁹ While the applicant and office staff indicated that no Hazel WSA prescriptions were applicable, the proposal is located within ARS No. 12, Hillslope Erosion Unit. The prescription for ARS No. 12 states in part: “Ground Based Operations: 3) no ground-based yarding on slopes greater than 30%.” The applicant’s response to Question 13 of the FPA indicates that the steepest slope within Units 1 and 2 was 40 percent. Absent of other information, the ARS No. 12 prescription appears to have been applicable.

The FPA was approved on August 16, 2010, and expired on August 16, 2012.

2012 FPA 2812449

FPA 2812449 was submitted⁴⁰ on April 16, 2012, by Grandy Lake and is located in Section 1, Township 32 North, Range 7 East. The proposal included an even-aged harvest of 6 acres and construction of 600 feet of temporary road including a temporary bridge over a non-perennial stream. The FPA is located approximately one-half mile northwest of the Hazel landslide area^{xxxi}.⁴⁰

The Hazel WSA prescription for ARS No. 6 was identified in the proposal and documented in the FPA materials. The applicant made an incorrect reference in the FPA to “now expired Hazel Watershed Analysis” but still identified ARS No. 6 and its associated prescription^{xxxii}.⁴⁰

The proposal is also within the mapped ARS No. 12; this author’s review of FPA information indicates that ARS No. 12 requirements were met by applicant by stating in response to Question 25 that “no slopes within the unit or road location exceeds 25%.”

^{xxviii} Endnote 39: FPA 2811279 Watershed Analysis Worksheet reviewed by BN 8/2/10

^{xxix} Endnote 39: FPA 2811279; Forest Practice Field Compliance Form, LiDar, Ortho map

^{xxx} Endnote 39: FPA 2811270; Forest Practice Field Compliance Form and Forest Practices Application File Log

^{xxxi} Endnote 40: FPA 2812449 questions 10 and 13

^{xxxii} Endnote 40: FPA 2812449 questions 25 and WSA worksheet

Todd Olson conducted a pre-approval site visit to review the proposed road and verified that no wetlands existed^{xxxiii}.⁴⁰

The FPA was approved on May 1, 2012, and expired on May 1, 2014. The approval conditions included a 48-hour notice, timing restrictions on bridge installation, and soil stabilization requirements^{xxxiv}.⁴⁰ The bridge installation condition required: “The bridge installation must be conducted within the time frame of May 1 through October 15 – during the life of the permit.” The condition is consistent with ARS No. 6 which states: “temporary stream crossing structures shall be removed by October 30 of the same year; bridges, culverts and fill materials will be removed and the road within MWMU will be stabilized.” The condition establishes the specific timing for the bridge installation. The prescription identifies the date when the bridge must be removed.

FPA review conclusions

This investigation identified the following concerns:

- FPAs 2807159, 2808883, and 2812449 proposed either temporary road construction or road abandonment that required the applicant to provide additional information, but the documents reviewed for this report did not contain these plans, nor is there a record that FP staff requested that information. This additional information, which is identified in the FPA instructions, includes a written plan to describe how erosion control and the restoration of natural water drainage and movement will be accomplished. Northwest Region Forest Practices was provided road abandonment standards for DNR state lands to keep on file so that the same information does not need to be provided repeatedly. However, FPA 2808883 (submitted jointly by Grandy Lake and DNR state lands) does not make reference to these standards. No similar information was on file with the Northwest Region office for Grandy Lake that would have satisfied this requirement for the other FPAs reviewed^{xxxv}.³²
- FPAs 2808883, 2810523, and 2812449 were approved with extensive conditions and do not appear to have been processed correctly for the following reasons:
 - Applications that do not contain the information necessary to be considered “complete” should be disapproved and returned to the applicant, or withdrawn voluntarily by the applicant upon notification that disapproval is imminent (WAC 222-12-030).
 - Applications that propose activities without stipulating the use of and adherence to applicable WSA prescriptions should be processed as Class IV-special applications and undergo SEPA review (WAC 222-16-050(1)(g)).
 - Rules generally prohibited DNR from applying further FPA approval conditions on applications that implemented approved WSA prescriptions (WAC 222-22-

^{xxxiii} Endnote 40: FPA 2812449 FP Field Compliance Form

^{xxxiv} Endnote 40: FPA 2812449, Notice of Decision dated 5/1/2012

^{xxxv} Endnote 32: FPA instructions question 10 or 12 (depending of instruction version; based upon the FPA submittal date) and interview with Rich Dodd

- 090(1)(e)). No additional restrictions could be placed upon the applicant beyond those required by the WSA prescriptions, except where mapping or other factual errors were found.
- Program expectations clearly discouraged the use of FPA approval conditions to restate standard rule and prescription requirements, or to compensate for the applicant's failure to include information required by the application instructions.

The practice of extensive conditioning appears to have been common. Approval conditions applied to above-listed FPAs may have been designed to meet Forest Practice rules and WSA resource protection requirements by correcting faults in incomplete applications. While perhaps well intended, the practice is contrary to rule and program guidance.

- FPA 2811279 was approved under the condition that cutting line boundaries were properly identified. Field marking is a required component of a complete application. Program expectations and Question 23 of the FPA instructions include a requirement for the applicant to mark boundaries on the site. Agency procedures address specific expectations regarding the quality of field marking but the FPA instructions do not include this level of specificity.
 - “If identifying markings or features are not clear, found to be absent or incomplete during field review, pre or post application decision period, the forest practices forester may use the appropriate enforcement tool necessary to gain sufficient field identification to be certain of compliance with the rules.”⁴¹

The record does not contain information on the amount of additional marking that was needed, but the practice of using FPA approval conditions to achieve a complete application is contrary to rule and program guidance.

- FPA 2810523 was renewed. New public resource information regarding the peregrine falcon became available to DNR in the time between original approval and the renewal request that should have required the FPA to be resubmitted instead of being renewed. On renewal, in response to this information the FPA was approved on the condition that activities adhere to the timing restrictions for the species required in WAC 222-16-080(f). While the conditioning provided equivalent protection to that identified in the rule, it circumvented the necessary review under SEPA required for all Class IV-special FPAs. Had the FPA been resubmitted with an amendment to incorporate these protections rather than achieving them through conditioning, the processing of the FPA would have met rule expectations.^{xxxvi}
- Documentation of pre- and post-approval site visits was limited on older FPAs. Concerns about the thoroughness of documentation were identified in previous application processing audits conducted^{42, 43} by Forest Practices program staff in 2006 and 2008. The applications reviewed for this report illustrate improvement between 2004 and 2012. The amount of field

^{xxxvi} At the time the renewal was processed, the peregrine falcon was listed as critical habitats of threatened and endangered species in WAC 222-16-080(1)(f). FPAs that proposed harvest, road construction, aerial application of pesticides, or site preparation within 0.5 miles of a known active nest site, documented by WDFW, between the dates of March 1 and July 30; or harvesting, road construction, or aerial application of pesticides within 0.25 mile of the nest site at other times of the year were classified as IV-Special and required to undergo SEPA.

documentation has also increased as a result of program-wide guidance and expectations for documentation.

3.3 Conclusions

The scope of this investigation is to describe these FPAs' compliance status with respect to regulatory requirements in place at the time of approval.

The record indicates the 2004 FPA (2807020) adjacent to the Hazel landslide groundwater recharge area, as submitted to DNR, was in compliance with the rules. The FPA proposal avoided Hazel landslide groundwater recharge area (ARS No. 2) and therefore did not trigger the Hazel WSA prescription's requirement for further study.

The primary factors determining the harvest's compliance with the Forest Practices rules are the location of the harvest boundary flag line in relation to ARS No. 2, and whether the harvest itself exceeded this flagged area or in some other way failed to comply with the FPA. The final Hazel WSA cited the potential for mapping inaccuracies and therefore specified that map unit boundaries (such as ARS No. 2) were to be field-verified. In this case, the applicant was responsible for locating the Benda-mapped boundary or the area topographically "directly upslope" from the landslide that depicted the boundary, if there was in fact a difference between the two. While the record is unclear about when, how, and by whom the line was installed, it was known that three people knowledgeable about the WSA (Osborn, Miller, and Stevenson) completed a site visit to review groundwater recharge area issues. Based on the information available, the compliance status of the harvest boundary flag line's location is inconclusive.

Post-approval compliance visit documentation by DNR states the FPA was in compliance but does not further specify the extent of the site review. The FPA estimated 7.5 acres to be harvested whereas calculations based on aerial photography indicate approximately 8.5 acres were harvested. The completed harvest is therefore not in compliance with the approved FPA's harvest acreage.

The compliance status was also reviewed for other FPAs within approximately one mile of the Hazel landslide on the north side of the North Fork Stillaguamish River that were received between 2004 and present. The record shows that at least one field review was conducted prior to approving each FPA, with one exception: a resubmittal of an earlier application that had already been field reviewed. Post-approval compliance checks were documented on three of the five approved FPAs during this time period.

The investigation found that several FPAs were disapproved by DNR or caused by DNR to be withdrawn by the applicant due to incomplete information. In other cases, extensive approval conditions were placed on FPAs which may have been designed to achieve the Hazel WSA and Forest Practice rules' protection requirements by correcting faults in incomplete applications.

The practice is contrary to rule and program guidance because it results in some FPAs being approved without information that is required for a complete application.

Appendix A Forest Practices rules application process overview

Office review

FPA's are reviewed in a two-step process. Step one is an office review that includes an initial review of applicant provided information and a comparison of the proposals location with a variety of map databases.

Applicants are required to provide certain identified or required information. FPA requirements can be found in RCW 76.09.060, WAC 222-20-010, along with the FPA form and instructions. Additional information may be requested of the applicant at any time. FPA's that contain insufficient information are not acceptable and returned. The current FPA form and instructions may be found on the DNR website or in hardcopy at DNR Region Offices:

http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticesApplications/Pages/fp_forms.aspx

Two databases have primarily been used by Forest Practices staff to assist in identifying potential risks to public resources in the office review process (Appendix C):

- The Total Resource Allocation Cross-reference System (TRAXS) has been in use since the early 1970s by DNR Forest Practices to identify potential environmental impacts of planned land management activities. TRAXS data is tabular data that is queried and displayed by Section, Township and Range. The data are organized into approximately 50 “data types” including Forest Practices Sensitive Areas. Circa 1998 tabular records were added that identified the areas included in the Hazel Watershed Analysis.
- The Forest Practices Risk Assessment Tool (FPRAT), a GIS-based tool used by Forest Practices staff to evaluate FPA's. The tool contains a variety of map layers providing information on cultural resources, water typing, wetlands, water supply, soils, slope stability, roads, topography, threatened and endangered species, etc. The tool has evolved over time:
 - 1996 to 1998: Identified process to evaluate FPA's for field review or conditioning⁴⁴
 - Between 1998 and June 2006 start of FPRAT): Wildlife and soils information available on GIS⁴⁴
 - 2006 to current: a FPRAT GIS viewing tool was available to both office and field staff

Office review results in an initial FPA classification per RCW 76.09.050 and WAC 222-16-050 and the distribution of the materials using the Mapping Application & Planning System (MAPS) or Forest Practices Application Review System (FPARS)^{xxxvii} Both systems are computer-based and provide a way for interested parties to be notified and receive copies of applications

^{xxxvii} MAPS computer system used between 1997 and 2002; FPARS computer system used beginning in fall 2002.].

electronically. Any person can identify themselves as an interested party. FPARS allows the public to search for FPAs online at any time^{xxxviii}.

Forest Practices activities are classified in four categories per WAC 222-16-050 and RCW 76.09.050. While the classifications are numbered I through IV; the order used to classify a proposal is not numerically sequential. The evaluation begins by a determination if SEPA is required – Class IV-Special followed Class IV-General, Class I, Class II, and Class III.

Class I activities have no direct potential for damaging a public resource. Activities can be conducted without an FPA. WAC 222-16-050(3) lists those activities that have been determined to have no direct potential for damaging a public resource.

Class II activities have been determined to have less than ordinary potential to damage a public resource. Activities identified in WAC 222-16-050(4) require the applicant to submit an FPA form to DNR. The proposed activities may begin five calendar days after the receipt of a complete notification WAC 222-12-030(2).

Class I activities do not require an FPA.

Class II activities require an FPA notification.

Class III and IV require the FPA to be approved before work may commence.

Class III activities are those activities that are not Class I, II, IV-Special, or IV-General. WAC 222-16-050(5) contains a list of some of the Class III activities, the list is not meant to be complete. Activities in this category require an approved FPA from DNR. The proposed activities are currently approved or disapproved within 14 to 60 days. The Class III FPA discussed in this report required approval or disapproval between 14 and 30 days based on the rule language at the time.

Class IV-Special activities have been determined to have potential for a substantial impact on the environment and require environmental checklist in compliance with SEPA. WAC 222-16-050(1) provides a list of specific activities that require SEPA along with a few exceptions. FPAs that are implementing WSA prescriptions and have no other Class IV-Special circumstances are classified using WAC 222-16-050(1)(d)(iii). The proposed activities are currently approved or disapproved within 14 to 60 days.

Class IV-General activities that are specified in WAC 222-16-050(2) and are subject to the SEPA review process. The proposed activities are currently approved or disapproved within 14 to 60 days.

An Office Checklist form is used to document the office review process of each FPA. The form identifies the date the FPA is received, anticipated decision date, classification, summary of proposed activities, resources identified by office staff, and applicant provided details. A copy of the Office Checklist is distributed along with the FPA to all reviewers.

^{xxxviii} FPARS also allows applicants and the public to review information such as topography, water typing, roads, site class, soils, slope stability, wetlands, and watershed analysis areas displayed in a map format. Individuals with GIS capability can download additional GIS products from DNR's website.

RCW 76.09.050(5) identifies to whom DNR must distribute a copy of each FPA. Within two business days of determining the FPA is complete, a copy is provided to ECY, WDFW, and the applicable county, city, or town. In addition, FPAs are shared with affected Indian Tribes per WAC 222-20-120. Any person or entity may request notification of FPAs using FPARS on the DNR website (www.dnr.wa.gov)^{xxxix}

Field review

Forest Practices field staff review proposals prior to issuing an FPA decision. The Forest Practices field forester has the opportunity to review applicant-provided information, identify and conduct a site visit if needed, identify if additional expertise is needed (ID Team), identify if additional information is needed from the applicant, identify the need for additional conditions, validate the classification, ensure field marking, and make a decision.⁴¹

Forest Practices staff commonly request assistance from other agencies and organizations with additional expertise to form an ID Team. ID Teams are specifically required in certain situations including alternate plans, road location and design, and even-aged harvest.

FPA decisions

A Notice of Decision is issued for each FPA and is required to be completed within the timeframes identified in WAC 222-12-030 and WAC 222-20-020. “If the department fails to approve or disapprove an application or any portion thereof within the applicable time limit, the application shall be deemed approved and the operation may commence.”^{xl} The required decision timeframes are generally 30 days but may increase in length for certain application types.

FPAs that require additional information, propose activities that are not allowed, or have been classified incorrectly are disapproved or withdrawn by the applicant. An SWO is issued when Class II activities are misclassified.^{xli}

The Forest Practices staff is provided authority to place conditions on the approval of FPAs through RCW 76.09.050(4), and WAC 222-20-020(1). Conditions are added to an application at the time of application approval when necessary to protect public resources. The requirements are specific to the activity and provide specific restrictions beyond rule requirements.

Conditioning authority is provided only for Class III and IV applications

Specific authority is provided in WAC 222-20-040(1) to require an applicant to notify the department two business days before operations begin. Applicant notification is specific to operations that are in proximity to water, soil conditions of the site, and potential to cause

^{xxxix} FPARS: http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticesApplications/Pages/fp_fpars.aspx

^{xl} ‘Application’ is a Class III or IV FPA. Class II notifications are effective five days after they are deemed complete.

^{xli} WAC 222-20-020 “Where a notification is submitted for operations which the department determines involve Class III or Class IV forest practices, the department shall issue a stop work order”

material damage to a public resource. The department determines which applications and situations warrant this condition.

In addition, the rules identify limited situations where DNR may waive a requirement or specifically approve an otherwise-prohibited activity. The waiver/approval can be done by a condition. Best professional judgment of DNR staff is used in these situations. Examples include:

WAC 222-30-060(2) No timber shall be cable yarded in or across Type A or B Wetlands except with approval by the department.

WAC 222-30-040(6) Waivers. The department may waive or modify the shade requirement where: The temperature method indicates that additional shade will not affect water temperature.

All parties have the ability to provide comment to the DNR on any proposal including Class III and IV FPAs have an identified comment period prior to the decision. Each comment received is reviewed by Forest Practices staff, evaluated on its merits, responded to when appropriate, and acted upon as necessary.

Each FPA decision is appealable by any party within 30 days of the FPA decision being made per RCW 76.09.205 and WAC 222-12-080. Currently appeals are filed with the Environmental Hearings Office and heard by the Pollution Control Hearing Board. Prior to July 2010, appeals were filed with the FPAB.

FPA compliance and enforcement

Field compliance visits are typically conducted by a Forest Practices forester. Forester workload is prioritized based upon the staffing levels provided by legislative appropriations for agency and Forest Practices program budgets, and program, region and forester priorities for compliance emphasis. While staffing levels and priorities fluctuate, the highest priority is typically established by the activities that have the highest potential risk to a public resource or public safety.

Forest Practices enforcement authority is described in Chapter 222-46 WAC. A variety of tools are available to DNR depending on the specific situation. The enforcement policy is described in WAC 222-46-010, including the use of a progressive approach beginning with the lowest level of enforcement to ensure compliance with the rules.

Tools available include Informal Conferences (ICN) which are required to be documented with written notes, Notices to Comply (NTC), Stop Work Orders (SWO), civil penalties, and Notices of Intent to Disapprove (NOID). The most common tools used to achieve compliance are ICNs, NTCs and SWOs:

ICN (WAC 222-46-020): The department shall afford the operator and/or a designated representative reasonable opportunities to discuss proposed enforcement actions at an informal conference prior to taking further enforcement action, unless the department determines that there may be imminent damages to the public resource.

NTC (WAC 222-46-030): If a violation, a deviation, material damage or potential for material damage to a public resource has occurred and the department determines that a stop work order is unnecessary, then the department shall issue and serve upon the operator and/or landowner a notice.

SWO (WAC 222-46-040 (1)): The department shall have the authority to serve upon an operator a stop work order which shall be a final order of the department if:

- (a) There is any violation of the provisions of the Forest Practices Act or these rules; or
- (b) There is a deviation from the approved application; or
- (c) Immediate action is necessary to prevent continuation of or to avoid material damage to a public resource. All FPA approvals are subject to any conditions stipulated on the approved application and to any subsequent additional requirements set forth in an NTC or SWO.

Currently, each enforcement document is identified by a unique number. Older enforcement documents did not have unique numbers (such as FPA 1909420 discussed earlier in this report).

Rule change implementation

The Forest Practices Act and rules have evolved over time. Changes affect new activities based upon when an FPA is submitted to the DNR. The date an FPA is received and identified as complete establishes which rules and guidance are followed for the processing and approval of the application. Those rules and guidance remain in effect for the FPA until it expires or is withdrawn by the applicant unless specific conditions are added at the time of approval or an NTC or SWO is issued to prevent potential or continuing damage to a public resource. (WAC 222-20-030 and -040)

Watershed Analysis Recent Updates

In 2007 and 2009, significant storms in western Washington produced intense precipitation events coinciding with a large number of landslides in particular areas. Some of these landslides occurred on slopes within watersheds with approved WSA mass wasting prescriptions. These storm events prompted concern by the Board about the use and review of WSA prescriptions.

In 2009, Forest Practices staff reviewed all approved mass wasting prescriptions specifically identifying which mass wasting prescriptions were specific versus non-specific. A landowner's FPA that uses non-specific mass wasting prescription requires SEPA review per WAC 222-16-050(1)(d)(iii)(C).

The Hazel Watershed's mass wasting prescription for ARS No. 2 was identified as non-specific.

The May 10, 2011, rule changes addressed gaps in the WSA review process by implementing new standards to keep WSA prescriptions current over time and provided DNR the authority to rescind prescriptions, replace rescinded prescriptions with standard rules, and provide an expiration of existing draft and interim prescriptions. Additional information can be found at: http://www.dnr.wa.gov/BusinessPermits/Topics/ForestPracticesRules/Pages/fp_rules_activity_archive.aspx

Forest Practices staff determined that three landowners wanted to maintain the approved WSA mass-wasting prescriptions. All other landowners opted to rescind mass-wasting prescriptions. A SEPA evaluation was completed per WAC 222-10-035. DNR notified interested parties on August 9, 2013, of the change. WSA information is still retained by DNR for use by Forest Practices staff and landowners as reference material when reviewing FPAs.

Hazel Watershed's
mass wasting
prescription rescinded
August 9, 2013.

Summary of recent unstable slopes FPA and guidance updates for Forest Practices staff and applicants

Regulatory clarifications, Board Manual, and internal guidance have been updated over time regarding unstable slopes, including groundwater recharge areas (GWRAs). Some examples since 2008 include:

- The Board requested that DNR review FPA processing on potentially unstable slopes – February 2008.
- GWRA guidance issued by DNR – June 17, 2008. Provided Forest Practices staff with roles and responsibilities when reviewing application within groundwater recharge areas. GWRA is assumed to be equivalent surface basin directly above the slide.
- Guidance issued by DNR regarding classification of FPAs involving potentially unstable landforms – October 31, 2008. Requested staff to scrutinize FPAs within WSA mass-wasting prescription specific to Class IV-Special determination.
- DNR issued guidance to Region Office staff on expectations for WSA worksheet – February 10, 2009. Completion of a WSA worksheet was required as part of processing FPAs beginning March 2, 2009.
- DNR reviewed all WSA mass-wasting prescriptions to identify whether they provided specific enough requirements – March 23, 2009. Each mass-wasting prescription was identified as specific or non-specific for the purposes of Class IV Special designation. Non-specific prescriptions were required to have additional evaluation by a person with a specific expertise.
- DNR revised the list of mass wasting prescriptions identified as non-specific based on public comments received; all other ARS's are specific – September 28, 2009.
- The Board completed rulemaking to better ensure that watershed analysis prescriptions continue over time to be protective enough to warrant an exemption from Class IV-Special classification – May 20, 2011.
- DNR completed SEPA decision process to rescind non-specific mass wasting prescriptions – August 9, 2013.
- The Board initiated rulemaking to clarify applicant expectations about additional geotechnical information on Forest Practices Applications (FPAs) that DNR may require where unstable slopes and landforms exist in and around the areas of the FPA – May 21 2014.
- DNR added questions to the FPA form regarding unstable slopes, and required applicants complete a new slope stability informational form – June 13, 2014.

- The Board adopted an update to Board Manual Section 16 regarding unstable slopes – November 12, 2014.

Forest Practices staff use of GIS

The Forest Practices Program uses GIS in a variety of ways. FPAs that include timber harvest are recorded in a GIS data layer based upon the applicant's proposed harvest boundary.

FPAs are submitted using a variety of different formats, from hand-drawn maps using visual indicators to more accurate maps created with on-the-ground GPS and advanced surveying tools. Both forms of mapping are acceptable under the Forest Practices rules.

The FPA map information is incorporated into Forest Practices databases by DNR staff, who create a digitized replicate of the applicant's map. The resulting Forest Practices GIS map is a visual representation of the applicant's work.

The GIS representations of proposed harvest boundaries areas are not adjusted in any way after the harvest is complete. Minor modifications made during operations are generally not incorporated into the GIS data.

GIS map products are not meant to replicate the exact location of activities on the ground.

The FPAs reviewed in this report have two different types of maps. Grandy Lake maps are hand drawn while DNR state lands maps are based on GPS and advanced survey tools. DNR receives FPAs from landowners with a wide variety of technical skill and mapping capabilities—from individuals owning small forest parcels, to large corporations.

Compliance with the FPA and the rules is not based on the GIS products created by the Forest Practices program. Compliance is based on the specific activities that occur on the ground and the field marking of harvest boundaries and road locations.

Appendix B Glossary

Acronym list

AMP – Adaptive Management Program

ARS – Area of Resource Sensitivity

CMER – Committee for Cooperative Monitoring, Evaluation, and Research

DNR – Washington State Department of Natural Resources

DNS – SEPA Determination of Non-significance

ECY – Washington State Department of Ecology

FP – Forest Practices

FPA – Forest Practices Application

FPAB – Forest Practices Appeals Board

FPARS – Forest Practices Application Review System

FPRAT – Forest Practices Risk Assessment Tool

GIS – Geographic Information System

GWRA – Groundwater Recharge Area

ICN – Informal Conference Notes or Notes on Informal Conference (document name changed over time)

ID Team – Interdisciplinary Team

MWMU – Mass Wasting Map Unit

NTC – Notice to Comply

RCW – Revised Code of Washington (laws)

SEPA – State Environmental Policy Act

SWO – Stop Work Order

TFW – Timber/Fish/Wildlife

TRAXS – Total Resource Access Cross- reference System

UPSAG – Upland Processes Science Advisory Group

WAC – Washington Administrative Code (rules)

WAU – Watershed Administrative Unit

WDFW – Washington State Department of Fish & Wildlife

WEC – Washington Environmental Council

WSA – watershed analysis

Definitions

DNR state lands – Lands owned by the State of Washington and managed by the Department of Natural Resources, also refers to the part of DNR that manages these lands.

Even-aged harvest – Harvest methods that generally require reforestation after the harvest has taken place, term often used interchangeably with “clearcutting.” See specific definition in WAC 222-16-010.

Forest practices – Activities conducted on or pertaining to forest land; such as harvest, road construction, thinning, salvage, etc. See specific definition of forest land and forest practices in WAC 222-16-010.

Forest Practices Application – Application to carry out forest management activities pursuant to the Forest Practices Act and Rules, acted upon by DNR.

FPA classification – Staff use information contained in the FPA along with a TRAXS report, maps, etc. to identify the FPA classification. The specific FPA classification determines the timeframe and how the FPA will be evaluated for the decision. Reference WAC 222-20-020(1); 222-12-030; 222-16-050(1)(d)

Public resource – Water, fish, wildlife, and capital improvements of the state or its political subdivisions (counties, city, towns).

Appendix C History of Forest Practices Risk Assessment Tools

Screening Tools	Total Resource Allocation Cross-reference System (TRAXS)	Risk Assessment Maps generated by Township in Workstation Arc/Info	FP Risk Assessment Tool IMS web mapping (FP RAT)
Screening Tools Description	Since the early 1970s, DNR’s proprietary and regulatory programs have used TRAXS to identify potential environmental impacts and business conflicts of planned land management activities. The Forest Practices Program has used TRAXS data to review forest practice applications for potential environmental impacts. TRAXS data is tabular data that is queried and displayed by Section, Township and Range. The data are organized into approximately 50 “data types” including Forest Practices Sensitive Areas.	April 1998 - Forest Practices Risk Assessment Maps were made available to DNR Forest Practices region staff. These maps were generated from the DNR Geographic Information System (GIS). The Risk Assessment Process was developed in 1993 as part of the Program for The Nineties. The process screened forest practice applications to identify factors that may pose a higher risk to public resources. In April 1998, the Forest Practices Risk Assessment Maps product was made available to DNR Forest Practices region staff. The Risk Assessment Maps product used Workstation Arc/Info and several GIS data sets to consolidate much of the screening data into two maps, “Fish & Wildlife” and “Water & Soils”. The maps could be generated through a series of interactive menus for any township in the state. These maps were used as tools by forest practices staff to assist them in the Risk Assessment Process. They used GIS data layers and were plotted at a fixed scale of 1:24,000 (1 "=20001) in a township format.	June 2006 – Forest Practices Risk Assessment Tool (FPRAT) is a mapping application available to all Forest Practices staff via the DNR intranet. The application is designed for use by Forest Practices staff who need to classify and review new Forest Practice applications (FPAs). The application allows users to easily view department and region GIS data, print maps, and produce specialized reports. This tool replaced the Workstation Arc/Info Risk Assessment Maps product. NW Region staff were trained in FPRAT use on June 29, 2006
Slope Stability Screening Data			
Forest Practices Sensitive Areas	Circa 1998 - Tabular records were added that identified the township, range and sections that were included in the Hazel Watershed Analysis. Some time before November 2003 - Tabular records were added that indentified the township, range and sections that were included in the Hazel Slide Settlement Agreement.	Not available in the Risk Assessment Maps product	Not available in FPRAT
Soils data layer	Not available in TRAXS	Starting with the initial role out in April 1998, the Risk Assessment Map - Water & Soils included polygons selected from the DNR Soils layer depicting Highly Erodible Soils, Unstable Slopes, and Very Unstable Slopes. The DNR Soils data layer was compiled as a state-wide GIS layer from the existing state soils surveys. The original purpose of the state soil surveys was to aid in assessing appropriate forested land tax rates. The original survey data was interpreted further to include slope stability ratings.	The "FPA Office Review Checklist" and the "Soils and Slope Stability" folder include polygons selected from the DNR Soils layer depicting Highly Erodible Soils, Unstable Slopes, and Very Unstable Slopes. These map layers have been available in FPRAT since June 2006.

Slope Stability Model (SLPSTAB)	Not available in TRAXS	Starting in April 2002, the Risk Assessment Map - Water & Soils included the Slope Stability Model grid covering western Washington. Cells were classified as "Most susceptible to Mass Wasting", "Moderately susceptible to Mass Wasting" and "Least susceptible to Mass Wasting". The maps also include the following caveat: "- SLOPE MORPHOLOGY DATA - These data have been developed from an analysis of USGS 7.5' topographic digital elevation model (DEM) data, as a FIRST APPROXIMATION, to show areas susceptible to shallow-rapid mass wasting, based on slope form and gradient. The resolution of the DEM significantly effects the amount of area modeled as unstable. Roughly 90% of known slope failures within a given area fall within areas designated on the map as susceptible. The remaining 10% are related to roads, yarding trails, and other management disturbances that occur irrespective of slope morphology. On-the-ground evaluations are essential, however, for accurate geographic delineation of specific mass-wasting sites. ** WA State Division of Geologic and Earth Resources."	The "FPA Office Review Checklist" and the "Soils and Slope Stability" folder include the Slope Stability Model (SLPSTAB). The model grid is symbolized such that cells coded as "Moderate Slope Instability" are shown in green, cells coded as "High Slope Instability" are shown in red. All other cells are blank.
Forest Practices Landslide Inventory (LSI) GIS data layer	Not available in TRAXS	Not available in the Risk Assessment Maps product	The Landslide Inventory (LSI) data layers (lines and polygons) have been available in FPRAT since June 2006. Additional related information for some landslides was added to the data layers in January 2008. Work was initiated by Forest Practices on LSI GIS data layer in 1999. All available landslide inventories and mass wasting map units from watershed analysis were collected from the various landowners and compiled into a common data set. Landslide inventories were also gathered from other agencies collecting data outside the T/F/W watershed analysis arena, such as the USFS, tribal entities, and universities. Updates to the LSI data layer were suspended in 2009 when funding for the Landslide Hazard Zonation Project ended. In the immediate vicinity of the SR 530 landslide, the LSI data layer includes six landslide initiation points identified as part of the Hazel Watershed Analysis and four large landslide polygons based on WA DNR Division of Geology and Earth Resources 100,000 scale geologic map series. No information has been found about when these polygons were added to

Forest Practices Hazard Zonation (LHZ) GIS data layer	Not available in TRAXS	Not available in the Risk Assessment Maps product	<p>The Landslide Hazard Zonation (LHZ) data layer has been available in FPRAT since June 2006. The goal of the LHZ data layer was to compile all known landslide hazard zones (also known as mass wasting map units) in the state of Washington. Information was compiled from previously existing watershed analyses, public, tribal, and private assessments, as well as data from LHZ assessments completed as part of the Landslide Hazard Zonation project. Updates to the LHZ data layer were suspended in 2009 when funding for the Landslide Hazard Zonation Project ended. The LHZ data layer contains mass wasting map units from the Hazel Watershed Analysis, including “Mass Wasting Map Unit 1: Large, active, deep-seated landslides along river bends”; “Mass Wasting Map Unit 2: Groundwater recharge areas associated with ARS/MWMU # 1”; and “Mass Wasting Map Unit 5: Slopes (>50%) on terrace flanks of lower elevation gorges and glacial terrace edges that typically have been incised by streams”. No information has been found about when these polygons were added to LHZ.</p>
10 ft. contours, 100 ft. contours, Elevation, and Hillshade data layers derived from LiDAR data	Not available in TRAXS	Not available in the Risk Assessment Maps product	<p>A LiDAR subfolder was added to FPRAT in March 2009. The subfolder contains 10 ft. contours, 100 ft. contours, Elevation, and Hillshade data layers for those areas where LiDAR data is available as DNR GIS Core Data. LiDAR data in the vicinity of the SR 530 slide was collected in 2003 (at approximately 2 meter resolution) and was part of the LiDAR data set added to FPRAT in March 2009.</p>

Appendix D Authors interview list

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Pat Stevenson	Stillaguamish Tribe

Others providing information:

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Patricia Anderson	DNR Forest Practices Division
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Endnotes

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